

May 30, 1960

# Aviation Week

and *Space Technology*

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IN898	50	50	100 (100)	100 (100)	1000	0.5
IN899	50	5	100 (100)	100 (100)	1000	0.5
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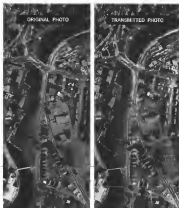
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(Continued from page 5)

- final Championships (venue: closed cover, aerial view, Fort Worth, Tex.)
- July 5-15**—Special Session Program in Internal Guidance—(Internal and External Guidance)—Massachusetts Institute of Technology, Cambridge, Mass.
- July 12-13**—Conference on Response of Metals to High Velocity Deformation, Stanley Hall, Fort Park, Colo. Sponsored by International Society of the Aeronautics Institute of Mining, Metallurgical and Petroleum Engineers.
- July 15-19**—Liquid Rocket and Propellant Conference, American Rocket Society, Ohio Union Building, Ohio State University, Columbus, Ohio.
- July 15-19**—Fourth Annual Symposium on Computers and Data Processing, Defense Research Institute, University of Dayton, Dayton, Ohio.
- Aug. 1-5**—Fourth Global Communications Symposium, Sheraton Hilton Hotel, Washington, D. C. Sponsored by Institute of Radio Engineers, U. S. Army Signal Corps.
- Aug. 1-5**—Fifth of National Aeronautics Institute (Classified Meeting), Institute of the Aeronautical Sciences, 10 Center Hall, San Diego, Calif.
- Aug. 5-11**—19th Annual U. S. National Air and Space Exposition, Fort Carson, Ariz.
- Aug. 6-11**—Western National Meeting, American Institute of Aeronautics and Astronautics, Santa Monica, Calif.
- Aug. 6-12**—1960 Pacific General Meeting, American Institute of Aeronautics and Astronautics, El Centro Hotel, San Diego, Calif.
- Aug. 15-20**—11th Annual Congress, International Astronautical Federation, Royal Institute of Technology, Stockholm.
- Aug. 16-19**—Electronic Packaging Symposium, University of Colorado, Boulder, Colo.
- Aug. 20-25**—1960 Cryogenic Engineering Conference, University of Colorado, Boulder, Colo.
- Aug. 25-26**—Western Electronic Show & Conference, Institute of Radio Engineers, Ambassador Hotel, Los Angeles, Calif.
- Aug. 26-Sept. 4**—1960 National Air Show, Municipal Airport, Dayton, Ohio. Sponsored by National Aeronautics.
- Sept. 4-5**—Confinement, Closed-Circuit Airplane Races, Lakefront Airport, Cleveland, Ohio.
- Sept. 5-11**—1960 Philadelphia Flying Day, Day and Exhibition, Society of Aeronautics and Astronautics, Philadelphia, Pa.
- Sept. 12-15**—1960 Annual General Meeting, IAFN, Copenhagen, Denmark.
- Sept. 12-15**—Second International Congress, International Council of the Aeronautical Sciences, Zurich, Switzerland.
- Sept. 14-16**—Annual Meeting, National Assn. of State Aeronautics, Westfield, Mass.
- Sept. 15-16**—1960 Annual Meeting, Annual Forum, Chemical Assn., Sheraton Park Hotel, Washington, D. C.
- Sept. 18-22**—National Symposium on Space Electronics and Videotape, Institute of Radio Engineers, Sheraton Hotel, Washington, D. C.
- Sept. 21-22**—National Convention and Aerospace Exposition, Air Force Assn., Civic Auditorium and Brooks Hall, San Francisco, Calif.



## CBS LABORATORIES PHOTOSCAN SYSTEM

Processing a tailored advance in aerial reconnaissance technology, makes it possible to transmit visual information from manned or unmanned aircraft to ground receivers in seconds, without loss of detail.

The high performance of CBS Laboratories' PHOTOSCAN is illustrated above. On the left is an enlarged portion of the original aerial photo which covered an area of sixty-four square miles. On the right is a portion of the retransmitted portion after transmission through the PHOTOSCAN System.

Challenging career opportunities are available at CBS Laboratories on long-range systems development programs such as PHOTOSCAN. Positions for physicists and electrical engineers are now open in the following departments: Military and Industrial Systems, Aeronautics and Magnetics, Solid State Physics, and Vacuum Tube Physics.

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FOR THE AIR FORCE, MSVD developed experimental 15th at obtaining 15th recovery vehicle, the RVX-2, impact even to be recovered. Vehicle, with its recovery package (upper left) developed for General Electric by Cook Research Laboratories, it shows how being based on board ship.

**MISSILE AND SPACE VEHICLE DEPARTMENT**

...center for missile and space technology research and development at General Electric

## Progress in search and recovery

With each recovery of a space vehicle, scientists gain important new knowledge about the environment of space and its potential effect on man and the operation of vehicles and equipment. As more advanced vehicles are developed for space flight—more with life aboard—successful location and recovery become increasingly vital.

General Electric's Missile and Space Vehicle Department possesses in the development of space vehicle search and recovery techniques as part of an re-entry and recovery vehicle program for the U. S. Air Force, MSVD developed and built the first payload to be recovered from space—an 18-inch data capsule ejected from an Air Force Thor re-entry vehicle on June 13, 1958. Many such data capsules have since been recovered from both Thor and Atlas flights—some carried cameras providing films from space. MSVD also developed and built the 15-foot long, ocean re-entry vehicle shown above which the Air Force recovered on July 21, 1959—the

largest and lightest space capsule vehicle, it is continuously expanding and improving its already successful search and recovery program.

Currently, the search and recovery capabilities are being applied to the development of such important space programs as the Air Force "Discoverer" recovery satellites and NASA's radiation research recovery vehicles (NERV).

For more information about MSVD's work in search and recovery, write to Section 160-70, General Electric Co., Missile and Space Vehicle Department, Philadelphia 4, Penna.

**GENERAL ELECTRIC**  
MISSILE AND SPACE VEHICLE DEPARTMENT  
 A Department of the Defense Electronics Division

# Armed Forces Standardize Microfilm

## Engineering Data Micro-reproduction System Covers Films, Punch Cards, Aperture Cards

The Armed Forces, operating active files containing more than 50 million drawings, have set military requirements for microfilming engineering drawings and related data.

The standards and specifications released April 15, 1980, by the Department of Defense for its Engineering Data Micro-reproduction System establish uniform methods for microfilming and standard formats for data presentation.

These uniform methods and standard formats, the Defense Department said, offer great space, time, and money savings.

New possibilities for inter-service exchange of engineering data are opened through the use of microfilmed drawings and related data, the Department of Defense announced.

### What does this mean to industry?

Military agencies using the specifications of the Engineering Data Micro-reproduction System will ask contractors to submit engineering data in 35mm roll microfilm and punch cards. From the microfilm and punch cards, each military agency will make aperture cards to distribute engineering data for the procurement, maintenance, and supply of the nation's weapons systems.

In addition, other military agencies may require contractors to submit completed aperture cards. In these cases, the master microfilm and distribution copies are furnished in mounted aperture cards.

Even now, a number of prime contractors and sub-contractors are using a portion of the newly-adopted specifications and standards. For them, the new requirements will be integrated into existing programs.

Many contractors, anticipating the standards and specifications, have held microfilm programs in abeyance. Their engineering departments now have a ready-made set of instructions for upcoming programs.

The new standards and specifications are expected to have a cumulative effect. As more companies have microfilm equipment, industry will intensify its use of microfilm for distributing data. Even before specifications were announced, prime and sub-contractors were exchanging engineering data in microfilm format.

### Industry helped set standards

Compatibility with industry is the keystone in the new standards and specifications of the Department of Defense. Industry comprises much of the engineering data used by the DOD. Industry, in helping to set requirements, has created instructions that can be used for its own operations.

### Standards cover broad areas

The standards and specifications documents already released are:

- MIL-M-9688, Microfilming of Engineering Documents, 16mm Requirements for;
- MIL-P-9679, Photographing of Construction/Architectural Drawings, Maps and Related Documents, 16mm, requirements for;
- MIL-C-9677, Cards, Aperture;
- MIL-C-9678 Cards, Tabulating and Aperture for Engineering Data Micro-reproduction System;

MIL-STD 804, Formats and Coding of Tabulating and Aperture Cards for Engineering Data Micro-reproduction System;

MIL-21319, Gaps, Aperture Cards No. 301-L. Interim Federal Specifications cover silver halide, diazo-type, and heat developing microfilm.

The complete Department of Defense standards and specifications cover:

- The raw film stock used in microfilm;
- The methods and techniques of microfilming engineering data for the Armed Forces;
- The formats of the tabulating cards used to generate aperture cards;
- The formats of the aperture cards used as carriers for the microfilm data;
- The methods and techniques of mounting microfilm into aperture cards;
- The wide range of equipment to be used in the micro-reproduction system. This equipment includes microfilm cameras, testing equipment to inspect filmed engineering data, film processors, film printers, and print-out units.

### 3M makes microfilm so easy to use

You can depend on 3M's continuing research, precision manufacturing, and standards-compliant products to make microfilm so easy to use.

FILMSORT Aperture Cards and Copy Cards, long used by Government and industry, are designed to meet the specifications and standards for the Engineering Data Micro-reproduction System. And

now, to speed your use of FILMSORT Aperture Cards, 3M supplies both the printed card and the aperture. You save in shipping costs. You get your cards faster.

FILMSORT Microfilm Copies, Mounters, and Readers are designed exclusively for FILMSORT Aperture Cards. They are engineered to make your micro-reproduction system profitable.



THIRMSO-FAX "Filmsort 300" Reader-Printer makes microfilm practical for industry and Government. The advantages of a reader and a printer are combined in one compact, low cost unit. Huge viewing screen... simple push-button operation... you can obtain copy after copy in 18" x 24" size, or half size prints, of engineering drawings and records from microfilm in FILMSORT Aperture Cards. The "Filmsort 100" Reader-Printer delivers 8 1/2" x 11" copies in seconds.

For more information about the new Defense Department microfilm specifications and how they affect your business, mail the coupon right away.

## Modern Microfilm Products from 3M



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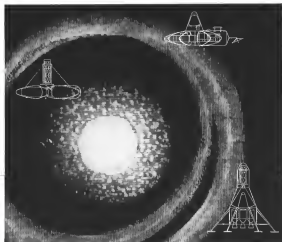
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Please send detailed information on the new Department of Defense standards and specifications and about 3M Microfilm Products.

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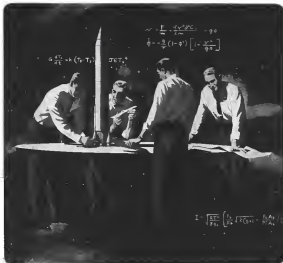
## New styles for the man-about-space



Every time a space traveler leaves home (earth), he has to wrap himself in the complete environment necessary to his physiological and psychological well-being. Styling sealed space capsules to suit man's every requirement has been a major project at Douglas for more than ten years. Forty basic human factors areas were explored in these studies. Now Douglas engineers have evolved plans for practical space ships, space stations and moon stations in which men can live and work with security thousands of miles from their home planet. The company's wide experience in producing large rocket and pressurized aircraft systems has provided it with unmatched capabilities in the missile and space fields.

Dr. Eugene Kennedy, Head, Life Sciences Section, reviews a new concept in space cabin design with Arthur E. Raymond, Senior Engineering Vice President of **DOUGLAS**

MISSILE AND SPACE SYSTEMS ■ MILITARY AIRCRAFT ■ OCA (JETUERS) ■ CARGO TRANSPORTS ■ AIRCRAFT ■ GROUND SUPPORT EQUIPMENT



## ENGINEERING TEAMWORK IN SPACE EXPLORATION

Engineers and scientists interested in a wide range of activities will appreciate the advanced nature of research and development projects under way at JPL. These projects include research, basic and applied, in Electronics, Solid State Physics, Propulsion, Aerodynamics, Structures and Materials and the design, development and analysis of space probes and satellites. Incredibly responsible engineers and scientists work together as a thoroughly integrated

team in accomplishing the complete objective. Programs involve guidance, teleoperation, data recording and reduction, instrumentation, structures, propulsion, materials, solid state physics, components heat transfer problems and systems analysis and are constantly influenced by continuing JPL space exploration research providing priority with challenging assignments in almost every phase of engineering and

science. Staff progress in diverse fields of activity is constantly being made. Pioneering in basic research, applied research and development engineering in space exploration proves to be a stimulating attraction for engineers and scientists with innate curiosity and intense interest in the future of space exploration. More men of this type are needed — if you believe you are qualified for the JPL team, send in your resume today.



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**Building the Athena** called for the development of new test systems capable of simulating the reliability of the more than 100,000 components in the 100,000 electronic address guide. All components were identified by precise state-of-the-art equipment, which also had permanent records of their performance.



**Athena** is the key and latest model of the computer for the Titan II ICBM. The Athena continuously computes the speed, direction, altitude, azimuth, and position of the Titan and compares this information with data stored in the memory. Responding to commands issued by the computer, the Titan maintains a course which will put it in target.

From the REMINGTON RAND UNIVAC

## Military Division

### Ultra-Reliable Athena Computer Guides ICBM Titan to Target 5,000 Miles Away

Recently an ICBM Titan missile was fired from Cape Canaveral by the USAF Ballistic Missile Division. The accuracy of the ground-based guidance system was such that technicians were able to quickly recover a data capsule within a target area 5,000 miles away.

This same system made possible the highly successful launching of TIROS I, America's television-equipped weather-satellite. The Athena computer, guiding a three-stage Thor-Able type missile, put TIROS I into the most nearly perfect circular orbit of any satellite, Russian or American, yet launched.

The Athena Digital Guidance computer was designed and produced by Remington Rand Univac to meet unprecedented reliability requirements. Several Athena computers have since been delivered and have logged thousands of operating hours. All have exceeded a reliability rating of 99.992 per cent, a record considered as a major breakthrough in the computer art.

The Athena is now a proven addition to the distinguished series of defense systems developed by the Military Division. In exceeding the contract specifications for reliability and delivering the computer ahead of schedule, the Athena program once more demonstrated the outstanding military capabilities of Remington Rand Univac.



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## 20-pound inertial platform

By a precise balancing process, this silent, sleepless "pilot" will keep its craft on course as it streaks through space. The miniature, all-attitude inertial platform detects any pitch, roll or yaw deviation and is the heart of a precise navigation system.

The best news of all concerning this new inertial platform is Norden's success in achieving higher accuracy and reliability... in a significantly smaller package. The unit measures a mere 7 1/2 x 9 1/2 inches and weighs less than 20 pounds. It offers optimum

state of the art wherever stabilized spatial reference is required. This engineering accomplishment once again underscores Norden's capability in the fields of digital computing, gyro design and application, reliability techniques, and precision manufacturing. And it is a demonstration of the Norden philosophy at work... to extend man's capabilities.

Simulating profiles are available at all levels of responsibility for qualified engineers and scientists.



**NORDEN DIVISION  
UNION AIRCRAFT CORPORATION**

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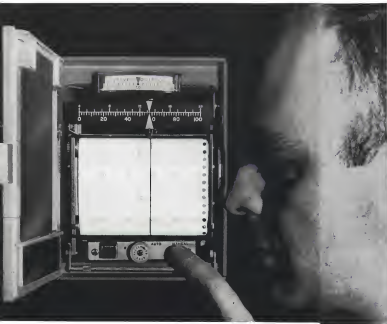
**DIVISION OF SPERRY RAND CORPORATION**  
Union Park, St. Paul 16, Minnesota

Control and data systems developed by the Remington Rand Univac Division of Sperry Rand Corporation, the General Business Computer Unit for the U.S. Air Force Titan II ICBM. The Titan II ICBM is the only Air Force Titan II ICBM.

BRAND Computer for the U.S. Air Force Titan II ICBM. The Titan II ICBM is the only Air Force Titan II ICBM. The Titan II ICBM is the only Air Force Titan II ICBM.

# New *ElectriK Tel-O-Set*... needs in a single compact

# everything an operator control station



This Honeywell electric control station meets all of your requirements for operator convenience.

One compact case houses every function the operator needs to supervise a control loop: indication of process variable and set point on the same scale; the controls needed to switch from automatic to manual; controls for manual control; and indication of valve position.

The *ElectriK Tel-O-Set* control station assures easier bumpless transfer than ever before available because there's no need to "lineup" or "match" pointers. A null balance indicator eliminates guesswork,

and the transfer doesn't have to be hurried since the valve remains under control during the transfer.

You can also order the controller with the proportional band, rate, and reset adjustments on the front of the panel conveniently located below the control station, or at the rear of the panel.

These are just a few of the features that make the new *ElectriK Tel-O-Set* control system an outstanding value. Your Honeywell engineer can give you complete details. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL,  
Fall River, Massachusetts.

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YEARS  
LOOKING TO THE FUTURE

**Honeywell**  
**H** First in Control  
SINCE 1888



- 1 Valve position indicator continuously indicates controller output when on automatic control.
- 2 Set point index is conveniently located on same scale as process variable pointer; you can see from a distance any deviation of variable from set point.
- 3 Reverser switch (subindicator chart is easy to read. At the end of chart speed, four hours of recording always visible. Unit has daily chart tear off or 30 day control data recorder and control station take the same 3/8" x 6" panel output.)
- 4 You get bumpless switching from automatic to manual control because you don't have to watch pointers. In this balance position, the valve position indicator is part of a null circuit that compares controller output and manual output. When indicator reads 100%, both outputs are perfectly matched.



## TRUE NORTH...anywhere-any time-any weather

A portable field instrument that finds true north automatically is now available to America's new mobile Army. It is called ABLE and has been TYPE CLASSIFIED by the U.S. Army, TO 4 E No. LIMITING. ABLE swiftly determines true north... day or night, in all weather, and anywhere in the world up to latitudes of 70 degrees.

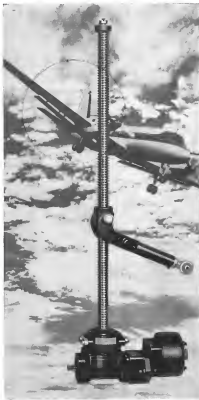
The simplicity, speed, and precision of ABLE compared with surveying methods means a saving in time, man-

power, and equipment... and is in keeping with the modern Army's concept of battlefield mobility.

Heart of the 100-pound ultraminiaturized system is a high-precision gyro which senses true north. Its accuracy is equal to most celestial methods under tactical conditions. ABLE components have a mean-time-to-failure in excess of 3000 hours. ABLE can also provide directional orientation for field-operated mobile radar and missile launchers.

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## Grumman Gulfstream

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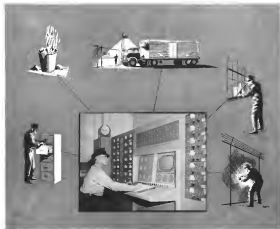
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## How Honeywell electronics improves classified area protection and lowers costs!

This completely new concept in protective systems enables one guard to do the work of many—more efficiently. From a central control panel, he can instantly check the security of any building at one-to-two remote points 30 miles or more away. Through electronic signals, the system detects all three means of detection—physical break in, audible noise created by the intruder and noise by weapons concealed within the area. It detects any form of illegal entry, looting, vandalism and sabotage, as well as fire. And it can provide complete surveillance of temperature, refrigeration, lights, boiler and flows.

No other method can begin to compare in savings and efficiency. By eliminating guard posts and increasing classified area protection, this security system can pay for itself within a year, and go right on adding to your savings year after year. For every 24-hour guard post that you eliminate, you save \$75,000. In larger areas, where more costs are distributed, savings increase proportionately. For a few more, call your nearest Honeywell office. Or write: Minneapolis-Honeywell, Dept. AW-5-118, Minneapolis 8, Minn. In Canada, write Honeywell Controls Limited, Toronto 17, Ontario.

# Honeywell



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## EDITORIAL

### Top Priority for Military Space Systems

The diplomatic obsolescence of the U2 and other forms of manned aerial photography over extremely tenuous and the success of the USAF Mafu early warning satellite development test operations have focused the international spotlight on the rapidly increasing importance of military space systems.

It is interesting to note that only a few short months ago we were still getting perturbation from our highest political leaders that there was no foreseeable military value in space. We are not likely to hear any more of this technicalistic naive bodge since the demise of the U2 generated an urgent national requirement for an effective surveillance system that can operate beyond the range of contemporary enemy defense and beyond the pale of diplomatic entanglements. This system must also operate with the round-the-world every 95 min. speed of a satellite rather than the much slower pace of the U2 photographic transmission belt.

The Mafu, with its infrared detection system, the Samos, with a capability for photographic and electronic reconnaissance, and the Corvus communications satellite together offer a solid technical hope for the creation of a military space system that will provide the best warning yet of a potential enemy's aggressive operations. In this uneasy age in which we live in almost instantaneous knowledge of a potential enemy's movements and his certain knowledge that we have the capability to obtain this knowledge in one of the most effective forms of deterrence from any aggressive operations.

It is appropriate to note here that many of our military and aerospace industry leaders were far more alert to the requirement for this type of reconnaissance-intelligence space system and much more aware of its technical feasibility than the political leaders, who until recently recoiled so amiably at the military use of space.

The original USAF WS-117L satellite reconnaissance program, variously called "Big Brother" and "Seneca," antedated the first Soviet Sputnik by considerable time. It is this program that, after interminable delays through management complications in the upper levels of Pentagon bureaucracy, finally emerged as the Discoverer research and development program aimed at providing the technology for Mafu, Samos and Corvus operational systems. Details of this research and development program can be found on page 57 of this issue in a report on USAF's 699th Satellite Test Wing at Sunnyvale, Calif., by Aviation Week associate editor Russell Hovels.

Most of the space technology achievements recorded under the U.S. flag since Sputnik have been laid on a foundation of ballistic missile technology developed by USAF's Ballistic Missile Division and its industrial and scientific contractors, although this fact has been largely obscured by a national public relations policy of throwing a civilian cloak over the application of this military effort in space research.

The record shows that, of the 19 U.S. satellites put into orbit, 12 were launched by RMD crews using the Thor and Atlas as boosters. Three of the five Pioneer space probes were also launched by BMD crews with USAF boosters. The Discoverer, Tiro, Transit and Mafu shots have demonstrated the precision guidance of a payload into predetermined orbits, stabilization of vehicles on an orbit so that they are in a constant attitude to the earth, regular communications from deep in space, instant of liquid rocket engines in space and transmission of specific data as ground command. There are still many technical problems to be solved before a space surveillance system will achieve the operational reliability required by a military operation, in contrast to exploratory research space vehicles, and before it can produce data of sufficient detail to equal the current performance from reconnaissance aircraft operating within the atmosphere's envelope.

Many people apparently are under the impression that the development of these space systems into operationally useful military systems is being pushed with top priority and all the speed possible.

Unfortunately, this is not true.

It is generally agreed in technical circles that the current state of the art on space systems is now far more advanced than was that of ballistic missile technology when the decision was made in 1955 to proceed with a policy of concurrency, developing the ICBM as weapons systems from the very start of the program. It was this policy of doing the research and development concurrently with the development of support, operational and logistics systems for these vehicles to be used as a combat-ready weapon system that brought the ICBM from the technical incubator in 1955 to initial operational capability in 1960—a phenomenally short lead time for any combat system.

Yet, this same policy has been discarded for the space surveillance systems. Valuable time is being lost as a result in an era when this commodity was never more vital and precious.

In addition, the research and development phase of the program is still being retarded by a penny-pinching, pound-fishy budget policy that has delayed construction of adequate launch pads and ground tracking, data collection stations.

Even the Pacific Missile Range ships cannot track Discoverer satellites and their ejected data capsules because hand instructions have cut the necessary tracking equipment from their decks.

It is time that we recognize the contribution that military space surveillance systems can make to the preservation of peace in the missile era and push their development at top priority with a streamlined military industrial management team that can achieve significant results within a time span to be truly effective.

—Robert Hertz





# HIGH TEMPERATURE CANNON PLUGS

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## Washington Roundup

### U-2 Repercussions

Regulation handling of the U-2 incident and recent debate will gain defense peler as a major election campaign issue. Defense issues will weigh this time, plus to discuss those issues fall in the coming months. Summit crisis rejected from Congress into a defense issue that had been treated in recent weeks.

Evidence, revealed that defense spending will be increased in the next fiscal year as a result of the summit failure. Senate Armed Services Appropriations Subcommittee will hear USAM Chief of Staff Gen. Thomas D. White and other service chiefs in closed sessions before changing the budget.

Gen. White has given two additional Atlas squadrons top priority in any budget increases. Further bid to add \$250 million for two squadrons lost in one vote in the House Appropriations Subcommittee. Gen. White rejected Senate proposals for a larger Atlas program because the extra Titans could not be in service before the Minuteman solid-propellant ICBM.

Recent Russian test successes have improved the congressional outlook since the House cut \$294 million from the program. House Military Appropriations Subcommittee expected the end by a close vote during a period of House-B tie failures.

White success for the B-70 is a good bet. This is strong Soviet support for USAF's request for an extra \$250 million, and the House is likely to go along to the extent of about \$90 million to ease the financial pinch. The program already has run into a \$20 million shortage.

Senate Majority Leader Lyndon Johnson is pressing for an increase in the B-55 program. Gen. White responded he would like to double the present 116 bomber program if there were no budget ceiling.

Congressional approval seems certain for a \$250 million MATS modernization fund. Arms Secretary Walter M. Bracken strongly supported the money, added by the House for interim managers, possibly the cargo K2-115 and long range G-402.

Navy is concentrating on its drive to get \$275 million for a carrier returned to the budget. Strategy is to push for the carrier instead of increased B-60s, since go back for more Polaris money in a supplemental request early next year.

### Bilateral Stalemate

U.S.-British bilateral negotiations appear stalemated at least for the moment. British delegation apparently was under stiff orders to make no concessions on U.S. rights beyond London during recent talks in Washington. U.S. has little in bargain with, since the British already have won all their major main goals. The seven TWA will without it. Frankfurt-Zurich link beyond London and Northwest still out in Hong Kong.

Sen. Sparkman (R-Ill.) is conducting a personal inquiry into NASA's claims of Douglas Aircraft to develop the SIV program. Inquiry could give rise to a demand for investigation of space agency contracting practices.

Inquiry is sparked by Sen. Thurmond's concerns over loss of business for his Florida constituents. At least one bidder, Chrysler Corp., agreed to build a Florida facility if it won the contract. Sen. Halland questions the chance of a company that will have to ship the SIV through the Panama Canal for testing at Hawthorne, N.J. and Cape Canaveral, Fla. He also said Douglas bid was considerably higher than others.

NASA defends the contract award on grounds of technical merit. The agency and studies indicate transportation will account for only 1% of total costs.

### British Missile Talks

British Defense Minister Harold Watkinson will discuss buying Skybolt and Polaris missiles during his U.S. visit this week. British are looking for missile nuclear systems to replace their canceled Blue Streak ballistic missile. Skybolt would be used to extend the life of British bombers. Polaris could be used as an or adapted to railway use.

Pressure for changes in federal regulatory policy and practices given in the Senate last week. Drafted in recent appointments to various agencies. Sen. Kenneth Keating plans to introduce a bill soon which would establish a National Advisory Commission on Administrative Practices and Procedures. This group would study such material in the context of former CAB Member Louis J. Brandeis. House Commission reports and past legislation than draft a long-range plan for attracting better qualified men to government service.

Senate Commerce Committee joined the critics of the current regulatory approach with plans for a sweeping investigation of all agencies, including CMB, next year. Sen. Warren G. Magnuson, committee chairman, and Sen. Jacob J. Aronson, representative of the law under which the agencies operate, rather than highlighting conflict-of-interest issues with individual board members.

—Washington Staff

# Titan, Atlas May Boost Rover Rocket

Use of Saturn for flight-tests of nuclear rocket also may be proposed under NASA study contracts.

By Michael Taylor

Use of Titan and Atlas as flight test vehicles for the Project Rover nuclear rocket is considered feasible and is expected to be a prime topic in studies developed by winners of a new NASA Nuclear Rocket Flight Test System Study competition (AW May 8, p. 25).

Other possibilities that will probably be studied are use of the Saturn and direct ground launching of the Rover without chemical boosters. The latter approach, however, is considered unlikely in light of potential radiation hazards and the high anticipated weight of the nuclear propulsion system which is expected to give the first Rover rockets a thrust-to-weight ratio of less than one. Use of the Saturn in initial flight tests will depend upon its availability.

Object of NASA's Nuclear Rocket Flight Test System studies is to define the initial Rover flight test program with minimum risk and maximum of techniques and ground support equipment as well as of actual flight vehicles.

Of the 40 companies that attended the recent launch conference, approximately 20 are expected to submit proposals, some in teams. Included are at least five major aerospace companies—Lockheed, Morton, Convair, Douglas and North American. Besides for the tests in May 11, after evaluating them, NASA will award three study contracts for 30 each and two for approximately \$150,000. Merits to industry's choice, the success of the funded study will probably be asked to contribute some time and money to their share in the project. But the winners are expected to have an early look at later test programs and development contracts which contracts also may be long enough to Merit Energy Commission data for the prospects.

At first it is expected to minimize the winners of in two new test facilities—nuclear rocket test centers, shortly. There will be studies studies, covering a range of test programs on nuclear rocket propulsion systems, including the Rover as well as others but more sophisticated studies.

Part of the studies will be to provide the Air Force with nuclear engine performance data—including costs, hazards, availability, etc.—that can be fed into the various vehicle studies to permit contractors for different possible reasons that the Air Force has already avoided. Presently without any role in nuclear rocket development, the Air Force is studying this work closely for possible future applications.

As for the plan, NASA-AEC Merit Energy Commission effort on Project Rover is orbital flight test of a prototype nuclear rocket on top of a Saturn launch vehicle in 1965, according to Mr. Gen. Don R. Osterman. Several studies of the tests, probably using Titan or Atlas boosters, are expected to precede this. From their work, in earlier studies such as the capped Air Force orbit SR 150, several actual comparisons are conducted that involving RCHM will serve adequately as sub-

orbital boosters for early Rover flight vehicles.

Morton Co., for example, has already developed a configuration based on the Titan test stage. Nuclear second stage of this configuration was preselected as Rover technology, and while actual purchase requirements of the current NASA competition are necessarily some projections of that work, the company feels that it nevertheless has demonstrated the basic capability of the Titan to do the job.

Initial nuclear rocket propulsion systems are expected to prove relatively crude and heavy affairs. The first stage especially will be designed to fire for approximately five minutes achieving a specific impulse of 750 sec, and a thrust of 50,000 lb. Engine will weigh about 10,000 lb and, including propellant, tankage and other hardware, over all weight of the first Rover rockets is expected to exceed 50,000 lb. Rover will be designed for a thrust-to-weight ratio greater than one, it is at all weight will drop as the system is refined.

Beyond the Rover is classified as a heat transfer nuclear rocket. Liquid hydrogen propellant or working fluid is pumped through a reactor core where it will pick up heat from the fissioning of uranium shims, and is then ejected through a rocket nozzle to produce thrust. Heat of the system in the reactor which will be based on AEC's work with the Keri test p. 50. Keri is an intermediate effort refers to the speed of the program which are the main source of heat reactor which, in double form, will be three to four feet in diameter and positioned at right angles of thrust.

Fuel elements in the Keri assembly will be uranium-enriched graphite. There will be identified elements and the engine will not have actual capsules. Some sort of control mechanism, possibly neutron absorbing rods, will be used to regulate power level and temperature.

Introducing a new element into the acceptance of the Merit Energy Commission will build the prototype rockets. Then, if AEC follows the program act with advance nuclear development in the industry expects it to do, companies will be asked to bid on research with specifications closely defined by AEC.

With such succeeding rocket projects, companies will be allowed some freedom in development.

For the future, government and industry are already thinking about nuclear rocket engines both larger and smaller but more sophisticated than the Rover. When fuel elements are

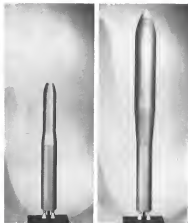
developed that are capable of withstanding the required higher temperatures engines and materials are, then that nuclear rocket engines can be built that will have specific impulses of 900-950 sec.

Atomic Energy Commission report also is keeping its Rover project also although for the present it is a low priority level. This is followed by a program for the development of a R, while nuclear rocket motors that could develop 10 times more thrust than the Rover, or approximately 500,000 lb. Particular after the Keri, the Convair motor would probably have about half the thrust and no instant capsules, like Rover, Convair will be designed with a thrust-to-weight ratio greater than one for use as a propulsion vehicle.

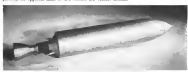
Others in the nuclear industry and in industry are now showing a great deal of interest in what the Merit Energy Commission nuclear rocket program is. As differentiated from the Rover test system (which some engineers are calling nuclear booster rocket), such as nuclear rocket engines will be designed for long duration, step-start operation in planetary orbits or space where gravitational effects are negligible. Suggested applications for such engines include orbit maneuvering, orbit transfer, anti-satellite, specific orbit is, as powerplants for satellites that could intercept and capture enemy satellites, and as engines for space bins and rescue vehicles.

Scientists would have found that weight ratios considerably under 1 probably is not in 10". For maximum use and weight, they would probably use fuel elements about 10 in. in diameter the Keri intermediate type tests. Fuel elements, which would have to last for 10 to 15 in. instead of just 5 to 10 min, would probably be built with the same weight, length or diameter. A considerably enriched uranium fuel would be used in place of the Keri's uranium-graphite fuel in order to prevent a self-sustaining reaction. In present discussion of the hydrogen and, therefore, use specific impulse, possibly to over 1,000 sec, the nuclear propulsion system would be operated at low pressure.

Considerably more sophisticated than Rover type nuclear rockets, nuclear rocket motors might also entail considerably more difficult development problems. For one thing, comparatively few test reactors have been built for use as test reactors and little is known about this technology. Fuel elements are harder to control than also in nuclear reactors. They operate without moderation to slow the neutrons and in the time from fission to fission is much shorter. This means that the control mechanisms for regulating temperature and power level will have to be faster and more precise.



**FIRST STAGE** of the Titan ICBM (left). Merit Co. says could be used as booster for a suborbit Project Rover nuclear rocket flight test vehicle (right). Above models, which are to the main site, show Titan in upper two-stage Keri configuration. Below, a nuclear rocket and new adaptive antenna in place of its second stage. Merit's nuclear rocket second stage, shown below without upper section, is based on Project Rover technology. Reaction is located between nozzle and liquid hydrogen tank. Two small propellers on opposite sides of the reactor are versus nozzle.



Test is with this is the problem of direct control, since the propellant will be used as a cooling agent for the fuel elements with the side of flow regulating constant temperature as well as rocket thrust. Aftercooling also controls a problem for the nuclear reactor engine. After the reactor is shut down the radioactive isotopes that have been formed continue to generate heat that must be dissipated.

As one company that is already working on some of the problems of nuclear rocket engines, Merit Co. notes that technology as this area is about five years behind that of the Rover type nuclear rockets. The first flight of a nuclear rocket could be made in 10 years. Merit engineers maintain, and nuclear rocket engines could possibly be operational in about 15 years.



# GAO Lists Objections to Management Plan

By Katherine Johnson

Washington—General Accounting Office recommended last week that the Air Force take over the scientific and engineering personnel of Space Technology Laboratories, fully-owned subsidiary of Thompson Ramo Wooldridge, Inc., and develop "in-house" industrial and management divisions to conduct missile and space programs.

In a report submitted to Congress, the President and the Secretary of Defense, GAO's main argument is that industrial reorganizations and reorganizations of missile and space programs—such as those currently being discussed—will likely affect the activities of many other contractors, hundreds of subcontractors and thousands of third-tier contractors and suppliers. It should be made by the Air Force rather than outside agencies, profit or nonprofit.

USAF could save money, GAO estimated, by directly hiring Space Technology Laboratories employees and eliminating the fee payment of a USAP (so-called "independent salaries and incentives" above the civil service level for these employees, if necessary. As an example of potential, GAO pointed out that 492 scientific positions in the \$2,700 to \$10,000 a year salary range have been authorized for Department of Defense.

"Whether the staff be government or contractor employed, the government will pay the cost of these professional services, just as for a contractor is involved," GAO said. Peas paid STL and its former parent firm, Ramo-Wooldridge Corp., from May, 1955, through May, 1962, total \$10,000,000, according to STL. With the separation of STL as a separate entity in 1958, the remainder of Ramo-Wooldridge was merged with Thompson Products.

USAF's plan to convert STL into a nonprofit organization, purchasing facilities estimated at \$20 million to \$30 million from Thompson Ramo Wooldridge (AW May 16 p. 35). GAO said, "would represent a state of the practice," including contracts between STL and government contractors and extremely high STL stock, earnings over a brief period. GAO added that "no alternatives before the transfer of systems engineering and industrial divisions in the programs of this enterprise is in close interaction with the management of the program itself and is so broad in scope that it more appropriately should be performed by a government agency."

The outlook is that the Air Force will move forward with its plan to convert STL to nonprofit status without con-

gressional intervention in view of its expected July adjustment, the advanced status of the USAP plan and the fact that it will correct the two major elements of the objection to STL's status as a profit organization—the conflict between STL and associations and the stock position of its officers and employees.

Air Force retained action to convert STL to nonprofit status following a report last fall by the House Military Operations Subcommittee headed by Rep. Otis (R-Ill.) (D-Calif.), demanding that this be done if STL is converted to industrial division of USAF defense management programs (AW Sept. 24, p. 140).

The general view of members of the Hillside subcommittee and other key congressional groups is that the Air Force should have taken steps to further develop its "in-house" capabilities over the past few years—a point highlighted in the GAO report—but that it is a step that has not been done, it is a step between the nonprofit arrangement and the conversion of STL to a USAP or in-house staff. Several congressional committees will carefully review the specific provisions for converting STL to nonprofit status, particularly payments to Thompson Ramo Wooldridge for its officers and sales staff. Salaries paid STL technical personnel have substantially exceeded those paid by other contractors and commercial firms, and research facilities.

## Withheld Predicted

GAO pointed out that Ramo-Wooldridge Corp., withdrawn as a USAP industrial division so that it could retain its technical knowledge on production contracts and control that STL is likely to be the main.

Even of the 14 top executives (who undoubtedly had acquired a wealth of knowledge of all other divisions of Ramo-Wooldridge as part of participation in the ballistic missile program, moved by Thompson Ramo Wooldridge after merger, while three joined STL.

"If STL's knowledge group through continued industrial engineering and technical direction, it would appear that the financial incentive to withdraw from the program would become increasingly pressing, while the Air Force would continue increasingly dependent on the capabilities acquired by STL," the GAO report said.

Although STL is barred from retaining activities related to its role as a contractor, the Air Force may be able to use the ballistic missile program, GAO said. "The Hillside staff that the Air Force had developed may be used by (STL) to complete for

production in related fields and as a defense program in a deterrent to full cooperation by the participating contractors. This funding to complete the work of the Hillside staff is avoided if the various engineering and technical direction were performed by a government staff."

GAO listed three examples of industrial contracts obtained by other firms—Woodward or STL that were closely related to ballistic missile programs.

• \$45 million USAP contract for development of the Pioneer lunar flight vehicle—Woodward or STL that were closely related to ballistic missile programs.

• \$50,000 subcontract from American Rocket Corp. for data processing equipment for the Titan intermediate-range ballistic missile program.

• \$14.6 million USAP contract for development and production of the autonomous data handling system for the WS17L military communications satellite program. Lockheed Aircraft Corp. is the weapons system contractor.

Manufacturers also have "a natural reluctance" to make information available to STL that might lead to competitive bidding, GAO said. The agency also reported that Ramo-Wooldridge and STL obtained ability to "many valuable inventions" developed under Air Force ballistic missile contracts. Space Technology Laboratories has "rejected thousands" to the government in contracts of National Aeronautics and Space Administration which cost per night with the government.

GAO declared that "the extensive knowledge in the value of modernization of the office, division and key elements of Ramo-Wooldridge at the time of the merger with Thompson Products" indicates the value of the knowledge and capability it had acquired in technical direction of Air Force's ballistic missile program. Class B common stock held by Las personnel owned an option for \$2.50 in 1955-56 estimated in value to \$300 a share at the time of the merger in November, 1955. The 18,790 shares purchased a few years previously for \$17,889 had a value of \$15.6 million.

GAO also reported on what it termed the "phenomenal growth" of Ramo-Wooldridge during its acquisition with the ballistic missile program.

• Total assets increased from \$247,848 at the time of its establishment in December, 1953, to \$49 million in November, 1955, plus a merger with Thompson Products, which placed the company in the hands of the Air Force, subsidiaries of \$2.7 million.

• Sales increased from \$2.2 million in 1954, the first full year of operation, to approximately \$50 million for the first 10 months of 1958.

• Sales from acquisition of the company through October, 1955, amounted to over \$134 million, exclusive of subsidiaries. Net income of Ramo-Wooldridge for that period amounted to \$6.7 million before taxes and exclusive of subsidiaries.

• Ramo-Wooldridge grew from three employees in September, 1953, to 4,334 in October, 1955. Personnel directed directly in the ballistic missile program amounted from 130 in December, 1954, to 2,795 in October, 1955.

The General Accounting Office began its investigation of Air Force management of its ballistic missile program a year and a half ago, after it said USAF refused to make available the complete report of its Inspector General on the program (AW Nov. 17, 1958, p. 34).

During its investigation, GAO com-

plained that USAF continued to deny access to key reports and documents, not on "security" grounds, but because Air Force said that such "sensitive" records that were given to its staff. GAO said, had been intended, and it was evident that information of a critical nature had been withheld. "Project officers were instructed that they were not expected to volunteer information to us."

An Air Force report evaluating all the automatic missile ballistic missile launches through 1958 was so altered that it was received by GAO and "statements which reflected unfavorable on the program was included," the report said. GAO said it also had been denied access based upon a USAF management survey of the General Accounting Office of General Defense. Copied, which was made in November, 1956, and a management survey of the Martin Co., made in December, 1959.

## House, Senate Conferees Boost NASA Budget by \$55 Million

Washington—House and Senate last week approved a joint conference committee report which boosted the National Aeronautics and Space Administration Fiscal 1960 budget estimates to \$470 million—\$55 million more than requested.

Action was taken to permit a quick request for additional funds to the \$55 million less in the event of technology aid breakthroughs in a model section in view of the progress without first asking Congress for more authorization.

In followed a warning by NASA Administrator T. Keith Glennan that he had given double the amount of money to maintain our present, scheduled activities and flight schedules with the funds authorized.

At the same time, both houses approved a conference recommendation to accept a House amendment authorizing NASA to establish a total of 20 positions within Civil Service pay scales, 10 more than first. This permits NASA a total of 13 positions in the \$19,000 to \$23,000 salary range; the remainder of the 20 would be in the \$14,000 to \$19,000 range.

The House first authorized an additional \$5 million for emergency construction and investigation, toward the \$915 million total requested by the Administration. The Senate later added another \$50 million authorization for emergency research and development. The House, however, actually cut \$1 million from the \$915 million in actual appropriations.

Conferees said this agreed to the Senate amendment of \$50 million in order to be sure that neither the space program nor the safety of personnel are jeopardized by lack of funds.

The "In fiscal year 1960 for instance, there have been major increases in Term 1 on the basis of the development of the Nuclear Facilities Recovery Capable (NFRV), and on the Pioneer V and the Explorer satellites. . . . We also would be able to fund an additional \$5 million for research for our 1960 lunar exploration program."

## Why Overrun

"The most serious reason that costs within estimates in research and development, as explained, is that it 'falls into the unknown where precise estimates are difficult—or, in fact, impossible to achieve in many areas.'" He added.

"Programs are changed to meet new developments, unforeseen difficulties arise, adjustments of activities take place to meet new schedules, cost increases are experienced—there are the difficulties, reduction of the research and development business. . . . I am sure you that NASA has an endeavor to absorb other cost increases which it needs for its or reductions in the funds available."

Glennan and the conferees said increases have had to be made at the expense of other programs since no emergency funds were provided. Since these programs have a long lead time, the House and Senate, he added, they need to get on with the more successful tasks.

"It seems apparent that the NASA has made little or no provision in its 1960 estimates for contingencies, cost increases in unplanned program modifications, the report said. "Unfortunately, necessary changes in order to ensure safety of personnel and system reliability such as the Project Mercury program cannot be accomplished by appropriations alone without adverse effects on other important elements of the space program. Furthermore, reductions have been received that several of NASA's programs have increased in cost over original budget estimates."

## Rising Costs

The report said current estimates for Fiscal 1960 already exceed the original budget estimates by \$35.5 million. This includes a \$14.6 million increase in the Atlas-Agena program, a \$100 million increase in the Thor-Agena program, and, according to Glennan, a \$1.5 million increase from a final decision to utilize the Centaur stage in the Saturn program.

Other examples of cost overrunning original estimates were given to the Senate Appropriations Subcommittee on Independent Offices, when Glennan appeared for oral testimony of \$38.9 million the House cut from the Fiscal 1960 budget.

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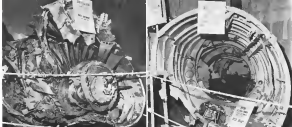
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**Soviet Rocket Chief**

Soviet Union's top rocket scientist (AW May 14, p. 27) will be headed by Marshal Mikhail Iosadovich Novikov. He formerly headed the Soviet army artillery and for the past 10 years has been the principal rocket administrator in the USSR Ministry of Defense.



**COMPRESSOR SECTION** (right) of the Pratt & Whitney J35-P-35 turboprop shown in Moscow's Gorki Park by the Soviets as part of the wreckage of the Lockheed U-2 lost near Sverdlovsk is apparently the largest and one that does normally used in military and civil versions of the engine. Compromised blades visible in the wreckage also appear to have larger dents than those on non-combustion versions. Blade failure prior to the engine P-35 may be improved by increasing its inlet area to provide a larger surface and by increasing the chord of its compressor blades to allow a more efficient pumping action on the low density air above 30,000 ft. Cause could be the compressor section was broken loose in the U-2 crash, and many

of the exposed blades were bent backwards rather than changing off, indicating that the engine was not running when the aircraft struck the ground. Condition of the blades at the bottom of the engine also was an indication that U-2 pilot Francis G. Powers made an emergency belly landing. Pratt & Whitney compressor practice in recent years has been to use titanium for most of the blades and parts of the compressor section of the J35 and other engines. Titanium lightens the structure of the U-2 in place of the steel of the rest of the tail section of the aircraft. Small ring braces to keep the light gap also from buckling are visible. The side lower brace is used as an attitude rest point for tail wheel fitting at bottom of picture.

## U-2 Carried Inertial Guidance System

Washington-Lockheed U-2 downed near Sverdlovsk (AW May 16, p. 22) carried a Massachusetts Institute of Technology inertial guidance system that permitted it to navigate accurately without relying upon external radio-navigation aids.

Inertial guidance system caused in some models of the U-2 now developed at the MIT Massachusetts Institute of Technology center as a state-of-the-art project.

Tufts' analysis of two pictures obtained from Moscow tend to confirm other information that the U-2 was a controlled emergency landing (AW May 23, p. 34) that it was not severely damaged at high altitude by a "rocket" as claimed by Soviet Premier Nikita Khrushchev. Details tending to show that the aircraft made a belly land are visible.

Damage to the J35 engine compressor section was confined to the underside, fuselage damage was scarce, along the bottom but extends clear light on the upper surface, wings were sheared cleanly from the fuselage and suffered moderate other damage, with the upper tanks on their leading edge almost intact, still in place and damaged largely on their underside, emergency escape appeared to show from winging along its bottom after impact with the ground. While President Eisenhower ordered

U-2 operations over the Soviet Union before the summit conference, the fact is necessary for U-2 operations in areas outside the Western Hemisphere.

The three Air Force personnel under investigation were taken to the Soviet Union for research purposes of National Aeronautics and Space Administration as well as civilians, but operations apparently have been halted.

Norfolk USAF operations with the U-2 by other units are continuing within the Western Hemisphere. These include mission measurements in South America and meteorological and infrared radiation on the U-2.

The three USAF personnel used to support NASA research operations are airborne in charge of U-2 strategic reconnaissance operations, although their aircraft are not used by the Air Force and their pilots and maintenance personnel are working under contract to civilian firms and taking orders primarily from the Central Intelligence Agency.

These three, weather reconnaissance squadrons and their bases are:  
• **Wings Air Base, Tokyo** from Weather Reconnaissance Squadron, Personnel (1st).  
• **Wings Air Base, Adana, Turkey** Weather Reconnaissance Squadron, Personnel (2nd).

• **Edwards AFB, Calif.** Weather Reconnaissance Squadron, Personnel (1st).

Weather reconnaissance flights in the case of NASA apparently have been discontinued since the U-2 was lost near Sverdlovsk.

Norfolk Air Force flight operations with the U-2, in which the pilots and all personnel are members of the service, have been confined to the Western Hemisphere, and they are continuing.

Three Strategic Air Command U-2s are now flying from Santa International Airport near Revere, Mass., Argentina on a three-week program as part of Operation Condor to measure the amount of radiation in the upper atmosphere below the equator.

This short flight program is intended to bring up to date data obtained in a USAF Atomic Energy Commission Argentine government research program conducted from the fall of 1955 to August 1959. Langley AFB, Va. Revere, in the training and personnel base for SAC U-2s.

An Research and Development Command has U-2 research from Edwards AFB, Calif., for two main purposes:

- **Support for the Mach 3.6 mission** research program through reduced measurements made at high altitude during the boost phase of X-301 flights.
- **Upper air meteorological research.**

## Congress Probes Summit Meeting Issues

Washington-Congressional inquiry into the U-2 incident and other circumstances surrounding the collapse of the Paris summit conference got under way on several fronts last week.

Apart from the partisan debate on issues involved, these developments are listed:

• **Sen. J. William Fulbright (D-Ark.)**, chairman of the Senate Foreign Relations Committee, hopes what he termed "an objective and impartial" investigation of events and policies which led to the summit failure.

• **Sen. Richard B. Russell (D-Ga.)**, chairman of the Senate Armed Services Committee, announced that its subcommittee on the Central Intelligence Agency will investigate the U-2 incident in cooperation with the Appropriations Committee.

• **Sen. Henry M. Jackson (D-Wash.)**, chairman of the Senate Subcommittee on National Policy Making, opened a "nonpartisan series of hearings" formed under the National Security Council and the problem of coordination between the Departments of State and Defense.

• **Sen. Stuart Symington (D-Mo.)**, a member of the Senate Armed Services Committee, urged Congress to appropriate \$15 billion above the amount authorized for defense by the Administration for fiscal 1962 to strengthen national defense "in view of the threat facing the free world."

• **House Foreign Affairs Committee**



## Neutralist Nations Keep Sharp Watch on UN Debate on U-2

New York—Telling shape behind the opening United Nations debate last week on the U-2 incident was the possibility that friendly nations would threaten reprisals on U.S. military aircraft operating within their borders. Delegates of countries not directly concerned were watching intently for signs that Pakistan, Norway and Turkey—and perhaps other states linked by treaty to the Western alliance—intended to extract U.S. aircraft movements before the UN Security Council.

Dramatic promises of his first session before condemning all of the United States for staging the U.S. Rights Secret Foreign Minister Andrei Gromiko specifically warned Norway, Pakistan and Turkey that they were "accomplices and parties to aggression." Nor did he mention that the U.S. had promised the one of them an base in connection with the flight of the U-2, disclosed on May 1 while 1,600 mi. inside the USSR, Mr. Gromiko said: "If the governments of these countries continue to support such actions, they may find themselves even against their will as a portion when the termination of their support becomes a war spreaded for aggression and conse-

quently the object of a retaliatory blow."

Although some of the threatened states are represented on the 11-nation council, their attitudes toward the Soviet strategy may reveal if the Soviet Union appears to advise disclosure of the Security Council to the UN's General Assembly.

Unofficially, a Pakistan government spokesman said that such a move against the U.S. Air Force flights from Pakistan airports would be a logical consequence of the U-2 incident to ensure against repetition. Pakistan, however, has rejected a Soviet charge that it had sent aircraft which threatened the U.S. flight, officially stating only that it accepted President Eisenhower's assurances that such reconnaissance missions should be stopped in sufficient self-defense. The spokesman of the Security Council, which was somewhat more reluctant than Western delegates had expected, warned the danger of an accidental war. Suppose, the British spokesman said, that the U.S. at the same time a U-2 was spotted on Soviet radar screens, either planes participating in NATO maneuvers in Western Europe also were pulled up to target.

The speaker said that, given the delicate evidence, the Soviet border that had already taken place, the approx-

**Mercury Booster Tested**  
First static firing of Redstone booster with isotropic Mercury capsule at 10,000 ft. test flight on May 2, 1960. The test was conducted by the U.S. Army Space Flight Center, Huntsville, Ala., and was the first of a series of tests to be conducted on the Mercury program.

of such aircraft would provide the command of the Soviet armed forces with all the means to conclude that a military aircraft was being launched against one country, and to activate by an automatic counter-blast" the foreign minister added.

In a Union rebuttal to the Soviet charge, Soviet Cabinet member U.S. ambassador to the UN, declared that surveillance flights "comprise to the state policy of the United States."

He then cited the Soviet refusal to accept President Eisenhower's open policy in 1958, that the U.S. would accept the inspection of the Arctic as recommended by the UN General Assembly and their refusal to consider "technical measures to prevent repeat attack" or controlled disclosure.

The Communist spokesman then said that flights similar to the U-2 mission included a nation's sovereignty and hence international law—an article by the Polish delegate, Polish delegate, said that the United States had not accepted sovereignty over their airspace, and that the U-2 mission was a violation of the 1948 Convention of 1948, and also in Article 4 of the Convention on International Civil Aviation of 1944, from which he quoted:

"The contracting states recognize that every state has complete and exclusive sovereignty over the airspace above its territory."

Although the theory question of sovereignty in the upper reaches of space alone a great action was ignored by Mr. Gromko when he addressed the council on May 25, the following day it was discussed by the U.S. UN delegate.

Great Britain, France, China and Italy, however, put forth the argument that the standard disagreement for international boundaries rendered the Soviet U-2 complaint insignificant. The implied non-Communist position was that the flight of an aircraft over another nation without permission was as much as a violation of international law as the comparable orbit of a space vehicle.

The absence of precedent with which the upper limit of airspace could be defined and related to national sovereignty seemed to be the central trend of UN space debate.

## Soviet Sputnik IV Re-Entry Try Fails

By Craig Levin

Washington—Soviet attempts to re-enter the orbit system of Sputnik IV have failed, according to satellite news a radio orbital separating it into several parts.

Soviet plans to separate the cabin from the satellite instrument suite (AMS) May 27, p. 271 and bring it back into the atmosphere failed when the instrument failed in the wrong direction. At the time, the satellite exploded as was separated into a mass of fragments, all of which went into a new orbit with a longer life expectancy than the original one. Sputnik IV was still functioning last week.

National Space Science Council, Central Control reported last week that the satellite was in orbit with a speed of 150 mi. per sec. at an altitude of 417 mi. and a period of 94.5 min. Last week, Soviet news agencies in the original orbit with a speed of 172 mi. per sec. at an altitude of 150 mi. and a period of 91.1 min.

Both orbits are in approximately the same plane.

As Sputnik IV went around to re-enter orbit, the center reported that several pieces began to appear as separate objects.

## Relay Reporter Satellite

Project Aboard in Cosmos, aimed at putting a 24-hr. relay reporter satellite in an equatorial orbit, has been delayed from its originally projected completion date of May 1960, p. 181, to that of a further launch. Development of the relay satellite is now in progress, and the launch is expected to be made in the next few weeks. The Advanced Research Project Agency-sponsored project is emphasizing reliability, because it will include a relay satellite for the first time.

Comet's controlled path, which will be used to test the satellite's ability to maintain its orbit.

Launch from Cape Canaveral, Fla., will be made by the vehicle, which is being used to test the satellite's ability to maintain its orbit.

Mr. Koenig's Italian-Soviet mission, project management, with Army Signal Corps Research & Development Laboratory responsible for the development of communication equipment.

Space Technology Laboratories is providing technical assistance and technical direction for all of the subelements except the communication system, which is being designed and built by the Army Signal Corps.

ports. Last week, seven new pieces had been identified as debris in the main satellite, both, and a reported 10 mi. for 20 the debris to go in a given point in the orbit. These pieces were in the main orbit in Sputnik IV or in orbit with a risk in its transfer. Most pieces were to be destroyed at that time.

At about the same time, the Sputnik IV re-entry failed, the Soviet Union center announced that the satellite had failed in the wrong direction. At the time, the satellite exploded as was separated into a mass of fragments, all of which went into a new orbit with a longer life expectancy than the original one. Sputnik IV was still functioning last week.

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As Sputnik IV went around to re-enter orbit, the center reported that several pieces began to appear as separate objects.

The 10,000 lb. Soviet satellite, which is a relay reporter satellite, is expected to be launched in the next few weeks. The satellite is expected to be launched in the next few weeks.

Relatives in the space probe again will be determined. The probe will be launched in the next few weeks. The probe will be launched in the next few weeks.

Mr. Koenig's Italian-Soviet mission, project management, with Army Signal Corps Research & Development Laboratory responsible for the development of communication equipment.

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satellite can be controlled both by its pilot and by ground stations.

Soviet scientist N. V. Naryan suggested that a satellite in orbit could be used to monitor the ocean surface. The satellite would be used to monitor the ocean surface. The satellite would be used to monitor the ocean surface.

Naryan said this mission can be achieved in two ways—using a satellite or a fleet of satellites. The satellite would be used to monitor the ocean surface. The satellite would be used to monitor the ocean surface.

## NASA Stops Operating Pioneer 150 Watt Unit

Washington—National Aeronautics and Space Administration has suspended operations with the 150-watt transmitter in Pioneer V and will not be able to transmit data over the range up to 10 million mi. once expected.

Relatives in the space probe again will be determined. The probe will be launched in the next few weeks. The probe will be launched in the next few weeks.

Mr. Koenig's Italian-Soviet mission, project management, with Army Signal Corps Research & Development Laboratory responsible for the development of communication equipment.

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## CAB Suspends Proposed Rate Increases

**Board action halts filing of widely-varied fares; order implies levels suggested so far are too high.**

By J. L. Doty

Washington—Civil Aeronautics Board issued a tariff suspension order last week and brought to a halt a continued drive of widely-different fare increases filed by trucklines in response to an earlier Board announcement that vaguely hinted it was ready to consider rate boosts.

The announcement gave no clue as to the level of rate which the Board would accept other than to state that the fair overall rate of return for the truckline industry has been set at "approximately 14.55%" (AWM May 8, p. 46). By the middle of late last week, the obviously worried announcement had evoked eight different interpretations from the 12 trucklines in claims for rate increases ranging from \$1 per ticket to 10% across-the-board above current rates.

The Board's latest order suspends the first four of these tariffs to be filed but gave assurances that a decision on a few level will be announced quarterly. It implied, however, that the proposed rates filed at the time the order was issued were significantly higher than the rate level the Board had in mind.

As of late last week, most observers felt that a Board announcement finally setting a fair level was imminent but were concerned that any serious establishment would fall far short of industry requirements. In its order suspending the tariffs, the Board warned that "an inference should be drawn as to whether the Board will or will not permit a further general increase in fares at this time."

The suspension order by the Board will not adequately "Tame" filings with an inevitable result of the announcement, and a broad range of proposed rates increases by the industry was expected because individual fare providers operate from collaborating with one another in working out tariffs. And, the Board was forced to suspend such tariffs since it logically could not approve a different set of rates for airlines competing with one another on identical routes.

#### Unknown Factor

Unknown factor in why the Board decided against setting a level for fares when the announcement was originally made, which reportedly was done with out the unanimous support of the Board members.

The announcement of a fair level occurred in February, 1958, established standards which permitted all carriers to file for the same fare increase without 48 hr. after the release was issued.

strike the lawful fares and protection" of such fares.

Of the tariffs filed, four carriers—Capital, United, Northeast and Western—totalled a 5% increase plus an additional \$1 on each ticket. American filed for an increase of 4% on all fares plus 1% per ticket except where existing conditions fares are more than one that greater than reach fare.

Eastern and National filed for a 5% increase plus \$1 per ticket. Delta proposed a 5% increase on all fares plus 1% Continental asked for a straight across-the-board 6% hike. Braniff filed for a 5% hike, Northeast for a 5% increase plus \$2 per ticket. Trans World Airlines asked for a 10% increase.

#### What Airlines Want

For more than two years, airlines have been calling for a fare increase that would give them what they believe is a fair rate of return on investment and a percent there to underwrite the some \$3 billion fleet expansion program now well under way. To support its filing, American Airlines submitted a letter to the Board in which it asked that the 5.2% rate of return the truckline averages between 1957 and 1959 be made slightly above the 5% return rate American was putting in its long-term loan contract.

American emphasized that airlines have been operating at overall losses for below the 10.5% "overall rate of return which the Board has now found they must be given the opportunity to earn." The airline asked that application of the fare increase proposed by American—4% plus \$1 on each ticket—would add some \$46 million in industry earnings, or a 9.7% rate of return on investment.

American, although predicting a marked improvement in earnings for the industry in 1960 despite a dismal first quarter (AWM May 5, p. 26), forecast a 55% return per cent for the combined 12 trucklines in 1960 as compared with a 50% return net profit after taxes last year. The airline thus noted.

After payment of some \$40 million for interest on debt, some \$38 million would be left for equity holders, who had an investment of \$870 million in the business at the end of 1959. Even assuming an increase of \$5 million investment net base over an amount at the end of 1959, for 1960 the rate of return an investment would amount

to only 4.5%. American pointed to depressed value of airline stocks as an indication that the financial community has become aware of the disastrous earnings slump of the airline industry. It stated that, as of May 13, common stocks of the domestic truckline had dropped from 30%—United to 65%—Capitol—below their 1959 highs. An average decline for the industry in both American and New York Stock Exchange listings was 45%.

Most value stock market points had fallen below their book value, the airline found, and stocks of seven carriers—American, Capital, Continental, Delta, Eastern, National, Northeast and TWA—were discounted to well 25% or more under book value.

The airline said in its letter that debt value of the truck firms had climbed sharply in recent years because of heavy borrowings covering the purchase of jet equipment. Ratio of long term debt for the industry to total capital has increased from 24.3% at the end of 1955 to 33.1% in 1959. With America said, "undoubtedly that it will still add further by the end of 1960."

#### Additional Financing

American said additional financing by the industry will call for a central strengthening of the equity position of the airline industry but it doubted that this could be achieved in the face of securities that continued to sell at depressed prices.

American noted that the initial decision of the CAB chairman as the General Passenger Fare Investigation in May, 1959, recommended an immediate increase in passenger rates of 51 per cent, with such further adjustment as proved necessary by experience. It said that this decision was based upon a calculated average rates of 14.55% during the five year period, 1954-1958, and an "assumed" operating profit of \$180 million for 1959.

Actual operating profit for 1959, American said, turned out to be only \$95 million—\$121 million less than assumed, a 6% return on investment in 1959.

#### Delta 880 Accident

Washington-Delta Air Lines Corridor 880 subject investigation ended on Island during a tailing light at Atlanta last week, killing all four crew members aboard.

Delta says for Alleghen's 269-mph investigation had determined probable cause for the accident was low fuel level on only on board, Delta was forced to postpone an 880 flight scheduled for investigation further between Dallas and Atlanta until sometime next month.

## 'Bus-Type' Service Requested On New York-Washington Route

By Robert H. Cook

Washington—Allegheny Airlines is making a strong bid to provide the first "bus-type" non-stop service between New York and Washington as a logical extension of its current non-stop flights on the Philadelphia-Pittsburgh market area.

Need for the new, lowest service was explained by the airline's officials last week in filings with the Civil Aeronautics Board which closely followed a similar filing made earlier by CAB attorneys in the New York Short Haul Cases investigation.

In a statement of tentative position, Board attorneys urged a new experimental "bus-type" service at least below present coach levels for the New York-Washington route. Noting that the Board is still gathering information on the available air service between the two cities, the attorneys proposed that CAB begin an investigation of the economic need for the proposed flights and determine if an airline should be authorized to provide the service. Hearings on the coach route, which began in May, have been resumed but are scheduled to resume on June 23.

Just prior to Allegheny to move to "no toll" service into the New York, short-haul market has been to consider the impact making removal of a present non-stop service from New York-Washington made with its application to coach service investigation.

In support of its proposal, Allegheny contends that, while trunk routes now provide coach service between the two cities, there are presently no special economy flights that might result in lower fares on the ground that they are economically unfeasible.

Noting that the New York-Washington market currently averages an average of 2,000 local passengers a day and provided the airline with a total of about 715,000 local passengers in 1958, Allegheny maintains that the trunk carrier cannot afford lower economy fares because they operate the route as the main market they handle a long-haul segment, complete with associated service and all customary ground handling services.

Under fares for Allegheny's 269-mph Philadelphia-Pittsburgh flight are \$20.05 last-class, only \$13 for the non-stop service, as compared with away-day and coach fares of \$15.79. Flight time is 1 hr. 6 min. for the bus-type service, Allegheny says, as for the piston-engine 440, according to

Allegheny. Competitive fares for ground transportation are 7 to 3 min. by rail; 6 to \$1 min. by auto and 6 to 10 min. by bus, Allegheny figures indicate.

Although Allegheny competes with TWA on New York-Washington, the non-stop coach service has succeeded in generating a greater passenger volume for both carriers during the past six months period, the Allegheny filing said.

Figures submitted by the airline's attorneys to CAB show that, out of a total of 25,571 non-stop passengers carried on the route by Allegheny, 12% traveled on the new non-stop service. Local traffic rates in the period last issued by 1959 as the same six months for a combined total of 74,747 passengers carried by both airlines.

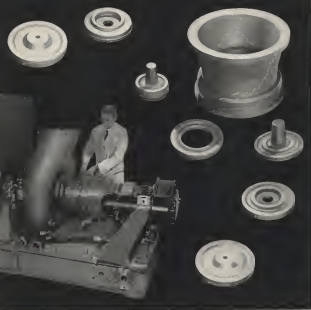
#### Opposed Service

Noting that, although TWA first opposed the service, Allegheny pointed out that TWA had not submitted its own non-stop plan after CAB approved the local economy carrier's plan. Rather than depressing the traffic volume, Allegheny said the new service would boost TWA's traffic along the Philadelphia-Pittsburgh route from 196,791 passengers between October, 1958, and March, 1959, to a high of 193,122 for the six months during which both airlines had provided the service.

As of late last week, Allegheny had carried 90,555 passengers on its present coach service, with an overall load factor in May exceeding 60% and one flight carrying 83% of the total passengers carried on the route since the new service began, 11,809 have used the non-stop service, which represents a doubling of such passengers carried as compared with ticket sales in last October.

Monthly rate of non-stop passengers by the airline is now beyond 7,000 a month on the route and Allegheny expects this volume to climb to 8,000 by the end of this year.

Allegheny's second report, which emphasized its new Boston-Washington route as one of the "richest, most productive markets for the country," shows that the carrier's overall revenues by 1958 and earned a small profit of \$16,254 out of total revenues of \$11.3 million, including indirect payments of \$5.4 million. Expenses for the airline climbed 32% last year but Allegheny stated that it added costs in flying equipment and maintenance.



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## CAB Blames Truck Beam Crack For 707 Landing Gear Failure

Washington—Inflight loss of two wheels from the left main landing gear of a Pan American World Airways Boeing 707 transport on take-off from New York International Airport last July 12 (AW July 28, 1979 p. 14) has been traced to a crack in the aircraft's forward truck beam assembly by Civil Aeronautics Board investigators.

An accident report by CAB last week said failure of Pan American mechanics to detect the crack was the primary cause of the landing gear truck beam during taxi-out and landing caused the initial crack.

The Board report added that the initial failure was further hastened by repeated braking on the wheels during gear attachment.

At the same time, CAB upheld the action of the Port of New York Authority and the New York City and police departments in handling record search watching at the airport as the aircraft ended the airport turning off.

Public breakdown of the airplane's flight CAB said, produced a traffic jam that delayed all seven roads to the airport, and Port Authority fire workers were forced to treat a hose as a canal of approximately 600 transient spectators who pulled around the aircraft after its successful landing.

Although the National Aeronautics Board has agreed to make specific requests of these agencies that reduce and release nonessential of emergency and avoid processing anything that might hamper the authorities' Board members and their intent to study this problem further.

Regarding the low-hour emergency, CAB said the wheel loss was first reported at approximately 37 p.m. when an inflight emergency reported warning the wheel drop from Pan American's flight 707 which had just taken off for London with 101 passengers and a crew of 11 aboard. Aboard the aircraft, the aircraft evaded the area at a low altitude for about one hour, during which time Port Authority personnel received the warning gear from shallow water in the bay at the end of the runway.

In answer to Capt. Edward F. Sweeney request, the last 3,000 ft of runway 11R was covered with foam in preparation for an emergency landing. During the time necessary for this task, the disabled aircraft continued to circle to burn off fuel in a means of reducing the low fuel hazard and reducing a higher landing weight.

Following the completion of emergency operations at approximately 11:25 p.m., Capt. Sweeney made his approach and touched down within the last 1,000 ft of runway, with the right main gear. Sweeney noted that, initially, no contact was made, as the left gear and nose wheels made contact, full reverse thrust was applied, something the aircraft is not designed to do in a straight course until the full weight is on the left gear and the left strut begins to drop as the runway, the accident report said. Application of the right brake held the transport on the runway, and it came to a stop approximately 1,200 ft from the runway end.

Emphasizing the landing gear assembly

## Capital Executive Shifts Continue

Washington—Capital Airlines last week again reshaped its management structure in another move toward creating a management program designed to strengthen its financial position so that it will eventually be attractive to merger considerations.

Under the revamped management, Dr. J. B. Baker, president of Capital since 1975, remains in that position but James B. Franklin resigns as senior vice president for operations and will return to active flight duty as captain. Further, Thomas B. Neuchuck, Jr., an investment banker, was named chairman of the board with full power to direct the airline's long-range financial policies (AW May 21, p. 14).

The latest organizational changes prompted by those days the deadline late last week when Capital was required to answer a franchise bid brought against it as a New York federal court in York, Pennsylvania (AW May 5, p. 9).

They also brought changes from the Capital Shareholders' Association, a stockholders' protective group organized by employees of the airline that the annual meeting of the board was "under review" and also claim to confuse the public and avoid the real issue—the level of directors.

The group headed by senior Capital pilot Charles F. Berrie, Jr. added "there is a new chairman, but the full complement of old there is still there."

The employee group plans to begin a common stock, proxy solicitation this week, calling for a special emergency meeting of all stockholders. At this time, the employees will present their own slate of directors which, they feel, will put the carrier back on sound operating and financial grounds.

CAB said that Pan American records showed that a "snubber" bolt failure on the aircraft had occurred five days earlier on a flight from Boston. Two days later a Pan attachment bolt in this part sheered off and was replaced with a temporary bolt. On completion of a continuing flight it was found that the temporary bolt she had sheered off, and the snubber assembly was removed and the aircraft flown to the field where the same snubber assembly was replaced.

Board members noted that the aircraft's landing gear design is such that a bolt will suffer the type of crack damage if the snubber unit is removed or broken from one of its fittings. In the case of flight 707, the forward truck beam could have been damaged during the flight from Boston after the snubber failed or in the later flight when the unit was removed, the Board said.

Meanwhile, Capital last week asked Vickers-Armstrongs for a further check in the forthcoming proceedings to give the revised management program design to work out a plan which, the directors feel, will give the airline an opportunity to sell, the \$35 million account due British shareholders on the unpaid balance of loans covering the purchase of a fleet of 50 Viscount turbo-prop transport manufactured by Vickers-Armstrongs.

Here are the management changes which will carry his made in the past two weeks.

• **Thomas B. Neuchuck** fills the post of board chairman left vacant when George B. Harris declined to stand for reelection. Neuchuck is the board chairman, the same Arthur F. Krieger was elected chairman of the executive committee, a position formerly held by Charles H. Wadsworth.

• **Marvin Wolfson** was named senior vice president for operations and management to take over direction of all activities, previously shared with J. B. Franklin, at the time he declined to stand for reelection. He is assisted by R. W. Wadsworth, senior vice president for operations.

• **John H. Maloney**, former vice president-marketing was named vice president-marketing and sales. He replaces Thomas Davis who becomes vice president public relations.

• **Rand Cluff**, former vice president-sales and marketing, was named vice president and sales. He will remain vice president between all departments and the president's office. John B. Anderson will replace Cluff as assistant vice president for sales. Anderson was former director of public relations for the company.



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## Examiners Debate CAB Reorganization

By Robert H. Cook

Washington—Theoretical litigations on means of streamlining Civil Aeronautics Board procedure are awaiting the rule of last year's criticism of the Board by former member Louis J. Blumenthal (AW Sept. 23, p. 16).

Latest critique of the Board's recent resolutions, which were thoroughly discussed by CAB members, was made by CAB Examiner Paul N. Pfeiffer.

While condemning the Board's proposal that CAB's major functions be transferred to other government agencies and courts in the "wrong way," Pfeiffer called for "less, rather than less, political action by the Board and suggested several means of streamlining CAB's present procedures and accelerating its workload.

A cross section poll of the Board's 24 members by Maurice Wertz failed to win unanimous support for Pfeiffer's ideas, although there was total agreement on some points of major importance. (Opinions of the full Board session on CAB reorganization needs were reported in an *Airline News* survey in the May 2 issue, p. 15.)

Porting out that he views as not intended to reflect those of the CAB as its staff, Pfeiffer suggested the following changes for streamlining and simplifying Board actions.

• **Planning functions** should be handled by an independent Office of Public Counsel with the sole purpose of representing the public interest rather than acting as a policy formulation bureau in consensus advice to the agency. This office, Pfeiffer said, should deal with all regulatory agencies and should have the right to appeal agency decisions when necessary.

Examiners' general work could shift on this issue, with those in favor feeling that the present hearing council function of the CAB was more suited to the post where they felt was best handled by a public counsel in part of the Board's General Counsel office. Those opposed said they did not believe such a change would offer any benefits from the present system and which the hearing council is a part of the Bureau of Air Operations.

• **Hearing processes**, particularly in complex economic cases, can be improved by having two, rather than one, pre-hearing conferences in order to reduce the time to be considered in the formal hearing. To further reduce the size of the Board, Pfeiffer favors that opening and closing statements be at hearings in a subsidiary, for testimony by public witnesses who, he says, "should not, without exception, go to the

examination, usually fruitless, cross-examination." Such practice, he believes, would serve to state the facts of the case without creating an opportunity for cross-examination. After the conclusion of the hearing, Pfeiffer says, both parties could then submit proposed findings of fact with supporting facts for adoption or rejection by the examiner as a means of expediting the preparation of an initial decision.

His particular proposal drew strong support from other Board members polled, who added that authority to hold two or more pre-hearing conferences already is held by the examiner who make individual decisions on this matter. Many cases, one examiner contended, should not require a pre-hearing conference. He also called for elimination of "so-called" expert testimony in favor of the specific and closing statements suggested by Pfeiffer and said that witnesses too often violate their conclusions instead of the facts of proof.

Another examiner, taking exception to the pre-hearing proposal, said that individual examiners often do limit.

policy sessions when functions and that one such conference is sufficient but that the time element needed to complete a hearing could be reduced by permitting the Board to issue a three-man order pending out the geographical area to be considered in the entire case and the selection or criteria qualified to take part in the hearing. Because, at such an order could be made by the Bureau of Air Operations, he said.

• **Examiners, properly equipped and staffed**, should be authorized to pass upon all interdisciplinary matters with such questions as who should be permitted to rehearse in the case. Scope of the matter should be actually determined by the assigned examiner. Pfeiffer said that procedural steps in many cases are often proposed to deliberately because existing rules require Board members to pass on each rehearing matter.

On this question, other examiners had conflicting viewpoints, with those in agreement saying that they "spare more room for independent thought." One of the major headaches cited by hearing progress was that examiners are



**Helicopter Society Honors President Eisenhower**

President Eisenhower was presented a plaque in recognition of his extensive use of helicopters by the American Helicopter Society at its annual meeting in Washington, D. C., shortly before the third anniversary of the Plaza and the casual crisis. Presenting the award was Ralph P. Alon, controller, outgoing president of AHS and chief of component design for Sikorski Aircraft Division of United Aircraft Corp., and Charles H. Korman, AHS' second chairman and president of Kaman Aircraft Corp. President of the society for the coming year is Art S. Johnson, general manager of Sikorski.



**The Republic F-105D streaks to a new world speed record...  
powered by a Pratt & Whitney Aircraft J-75 jet engine**

On December 31, 1959, the Republic F-105D fighter-number 44-80000, set a new world speed record over the Mojave Desert at 10,000 feet. The record was a 2.24 mile circle track at an altitude of 40 degrees below zero. The Air Force F-105D whipped through the closed course flight to establish a new world's record of 1,216.41 mph. Its highly advanced electronics, radar, and associated equipment, enable the F-105D to perform maneuvers at twice the speed of sound regardless of banking, climbing, or target altitudes. Its speed and power make it one of the most versatile weapons in history.

The jet engine that powers the F-105D is the Pratt & Whitney Aircraft J-75. This turbo engine also powers General's F-300 all-weather interceptor which recently set a new world's straight away record. Over the years, the Pratt & Whitney Aircraft J-37 and J-75 jet engines have broken virtually every major flight record.

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often forced to wait for CAB consolidation orders in some cases even before they are necessary under the rules.

"We can't even set exhibit dates, one emergency consolidation, without first knowing the full scope of the proceeding," he stressed, "that has lost of time while awaiting CAB consolidation orders often account for delays of as long as eight months before the examiner can make an initial decision. Those opposing this principle don't go on grounds that matters of such order is more properly the policy determining function of the full CAB."

• Findings of fact by the examiner should be final unless proven erroneous on the basis of the entire record. Phifer points out that the Administrative Procedures Act now requires agencies to make the fact actually found by the examiner. The examiner, he added, is "the only impartial person who has both heard and observed the witnesses and studied the entire record." Phifer also believes that such findings are done by an impartial person who must "work with a cold record" once he neither heard nor observed the witnesses.

Others on this issue also was divided, with many examiners pointing out that, while CAB has the authority to review facts, it can, and often has in the past, adopted those submitted by the examiner. Several agreed with Phifer, but others considered the re-

fusing of facts by the Board as a practical safeguard or double check on decisions.

• Opinion writing could best be accomplished under the personal supervision of an agency member assigned to that duty by the chairman. Phifer and Aichelsman would like the member on the case prior to oral argument and also would prepare the initial draft of a final decision under the member's personal direction. Such a position, the examiner said, would give greater assurance to case participants that agencies members have a personal familiarity with the record and the importance of the final results.

• Comments introduced during oral arguments should be given full and fair value in the suggestion and should be made. The present system is practical. These comments ranged from observations that the idea presents an advantage and could possibly be shown to be the present method of opinion writing by a specialized staff which bases its findings on the one record and testimony. The majority felt that CAB members should be personally responsible for the opinions they sign and add that dissenting agencies are usually the personal work of Board members.

• Final decision making also would be expedited by expanding agency membership to avoid the problem of obtaining a quorum due to other functions, such as participation in international route negotiations and industry conferences.

Phifer considered this proposal to the U. S. Circuit Court of Appeals for the District of Columbia which has some pages who often sit in panels of three. Only members of industry were important, such as the General Passenger Line and the Long Island Sound. As Chairman Livingston, should enforce the vote of the entire CAB, he said. Phifer added that the situation is comparable to the "one man" when the Circuit Court of Appeals sits in full strength.

Most of the examiners questioned were in favor of this idea and noted that the many trials required of Board members tend to "blame" their staff. As a group, they generally favored a one member Board with members being permitted to specialize in duties such as bilateral negotiations, economic and safety hearings. Some pointed out that a similar system is used by the Interstate Commerce Commission, but that the vast complexity of transportation work regulated by the agency makes an 11-member quorum a matter of practical necessity.

• Terms of agency members should be at least 10 years, with possible appointment for life and rotation duty among other regulatory agencies. Salaries of the members should be increased so that the combination of salary and government benefits would offset any need to leave the government for private employment.

## CAB Merger Decisions

Proposed merger between TWA and Northwest Airlines (AW May 25, p. 18) has again aroused speculation as to how the Civil Aeronautics Board will go in redesigning route structure and services of the domestic airline industry by backing of proposed mergers between carriers. The following table compiled by Aviation Week from CAB records shows that since 1945 the Board has reached formally to most proposals which have had a decided effect on competition within the industry and suggests that, unless the Board's policy on merger undergoes a drastic change, proposed before mergers that will benefit the industry's economy may get a cordial reception.

Date Filed	Action Issued	Approved	Denied or Dismissed
October, 1945	Western Airlines-Inland Airlines	May, 1946	
June, 1944	Realtel Airways-Bomber Airlines		March, 1946
October, 1945	American Airlines-Mid-Continent Airlines		September, 1946
December, 1945	Captial Airlines-Northeast Airlines		August, 1947
May, 1946	Northeast Airlines-Wagon Airways		December, 1952
July, 1949	Monarch Air Lines-Agass Airways	April, 1950	
September, 1949	Monarch Air Lines-Challenger Airlines*	December, 1949	
December, 1949	Pan American Airways-American Overseas Airlines	July, 1950	
April, 1950	Southwest Airways-West Coast Airlines		December, 1949
May, 1950	Mid-Continent Airlines-Piedmont Airlines		July, 1950
October, 1950	Continental Air Lines-Mid West Airlines		December, 1951
December, 1950	West Coast Airlines-Kaiser Airways	June, 1952	Dismissed
January, 1951	National Airlines-Colonial Airlines		
January, 1952	Realtel Airways-Mid-West-Continental Airlines	May, 1952	
February, 1952	Northeast Airlines-Capital Airlines		June, 1952
April, 1952	Delta Air Lines-Chicago & Southern Air Lines	December, 1952	
July, 1952	Eastern Air Lines-Colonial Airlines	January, 1956	
October, 1952	North Central Airlines-Lake Central Airlines		January, 1957
December, 1953	Continental Air Lines-Piedmont Air Lines	December, 1954	
May, 1955	Mackay Airlines-Matjet Airlines Corp.	October, 1956	

\* Consolidated into Frontier Airlines



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## SHORTLINES

► **British West Indies Airways** reports that it carried 215,059 passengers to a total of 47,344,196 revenue passenger miles in 1970—increases of 43% and 46% respectively over 1968. BWIA also recently began transatlantic service to the Caribbean, with weekly flights from London to Barbados and Trinidad and from London to Jamaica, both via New York.

► **Civil Aeronautics Board** began oral arguments late last week in the St. Louis-Southwest Service Case. This World Airlines had been given authority by CAB to fly from St. Louis to points in Florida and Georgia and had begun this service, stopping at St. Louis on direct flights to and from the West Coast. American Airlines, National Airlines, Delta Air Lines and Eastern Air Lines petitioned the U.S. Court of Appeals to vacate TWA's authority to service the route on direct flights, and the court ruled in their favor. The Board then agreed to allow permitting TWA to service the route so long as flights were terminated at Nashville or St. Louis.

► **Eastern, Mackay, Nahaan, North-west Airlines, Capital, Delta and North-west Airlines** have received Civil Aeronautics Board permission to fly mail between Ft. Lauderdale and Miami, Fla., for a period of two years.

► **Texas Caribbean Airways** has been recommended by a Civil Aeronautics Board examiner to receive rights to carry mail on a nonstop basis from New York to Puerto Rico over the short route of Eastern Air Lines, Pan American World Airways and Middle Air Lines. The three airlines contend that Texas Caribbean does not need the additional revenue which, they say, would be diverted from them, and that the service between New York and Puerto Rico is now provided by the three carriers in adequate

► **Western Air Lines** has secured co-operation from the Federal Aviation Act permitting it to lease an additional 14 Allison Model 501 D15 turbo-prop engines and 14 Aero-propellers Model A-1681 PW-406 purchased from Al-West, a subsidiary of General Motors Corp. Western had previously leased approximately 45 Allison turbo-prop engines and 45 Aero-propellers properties. Cost to Western is \$43,550 per engine and \$13,680 per propeller, which will be amortized over a period of five years in 20 quarterly installments at 6% interest on the unpaid balance.

## AIRLINE OBSERVER

► **Delta Air Lines** scheduling program calls for the introduction of other Douglas DC-8 or Conquest 580 turboprop transports into 10 cities on its routes in October. At that time, the airline will be operating a higher percentage of seat miles with turboprop than with piston-engine equipment.

► **Watch for new moves** by the airline industry to block avowed attempts by rail carriers to acquire other forms of transportation. In latest test case, Air Transport Assn. has petitioned the Interstate Commerce Commission for permission to intervene in hearings on application of railroads to acquire 94% interest. Airline officials are alarmed that railroads will next move to the air transport field if successful in acquiring other forms of surface transportation.

► **Eastern Air Lines** has completed major operating policy changes undertaken during the past six months. Financial result has been a sharp reduction in available seat miles which, in April, produced the highest monthly load factor the airline has recorded in 41 years. Customer service department, organized under the direction of Robert Harris, has been fully established in a majority of the carrier's stations. Purpose of the new department is to free sales organization of procedural and administrative burden so salesmen can concentrate on selling. Customer service, according to Harris, "delivers the goods sales has sold."

► **Newest Premier Nikita Khrushchev** has found a new source of irritation in U.S. aerial activity. U.S. jet aircraft which kept him awake during the summer meeting in Paris. "I've had enough of American jet planes," he said. "I'm sick of them." This complaint came when a photographer noted how he left the summit house of Soviet Architectural Style, Vassilievskaya, near Perm' City Field, after one night and slept elsewhere in the USSR, Leningrad in Paris. "You know all about the one that flew over our country—the U.S. espionage plane," he replied. "Then I came to Paris, and the sons of those American Air Force jet planes taking off and landing at Oak Airport, they sound as they sleep." Gals is also the crew, of considerable jet transport traffic, including Douglas 707 and Douglas DC-8 turboprop transports operated by international carriers, as well as turboprop Tu-154s flown by Aeroflot, the Soviet airline.

► **Sen. Clare Egan (D-Gold)** has introduced two bills in the Senate to ensure that the potential of the Administrator of the Federal Aviation Board are exercised reasonably. Sen. Egan, who looked into with FAA chief E. R. Quastel on several occasions during recent Senate Aviation Subcommittee hearings, and the purpose of the bills is to establish reasonable safeguards for licensed pilots under the administrator's authority.

► **San Antonio World Airways** will continue its program at New York International Airport of using a ground rule car to tell turboprop pilots when to cut power after taking off aircraft will create a maximum of noise over surrounding communities, whether or not the airport's noise regulations are made less stringent. This "First Alert" station system is mounted on a fully air-borne, in-flight, low-level, low-altitude turboprop system in use at London Airport. Station signaling with all the end of runway, completes 5-4-3-2-1 countdown, to pilot who cuts power at end of countdown. This avoids cutting power back too soon, which would put aircraft lower over community, or too late, which would put aircraft over other settled areas with higher power. San Antonio claims that noise performance of its aircraft indicates the Boeing 707-320 is better than the Boeing 707-120 in this respect.

► **MALEV**, Hungary's state-owned airline, expects to double passenger traffic during the nation's second five-year plan—1961-65. The carrier's goal is 220,000 passengers in 1965. Hungarian aviation officials estimate that by 1965, about 70% of the transport activity in the country from foreign points will be turboprop-powered, about 20% will be turboprop aircraft and only 10% will be piston-powered. MALEV expects to be operating Russian-built Il-18 turboprop transports "thoroly."

# Airline Traffic—March, 1960

	Revenue Passengers	Revenue Passenger Miles (RPM)	Passenger Load Factor (%)	U S Mail Ton-Miles	Revenue Ton-Miles	Freight Ton-Miles	Total Revenue Ton-Miles	Over-all Revenue Load Factor (%)
<b>DOMESTIC TRAFFIC</b>								
American	456,440	483,934	60 F	1,509,201	1,207,193	8,718,702	10,925,895	54 1
Boeing	187,381	84,347	31 S	419,445	144,212	459,196	603,408	43 2
Capital	164,637	121,336	49 S	386,412	294,199	444,172	738,371	49 3
Continental	300,912	87,686	30 S	144,476	111,202	804,444	915,650	39 2
Delta	271,798	183,486	66 F	489,486	361,719	3,212,302	3,674,087	49 2
Eastern	475,272	274,664	33 F	1,955,244	213,454	3,273,895	3,487,349	43 21
Northwest	167,408	152,627	64 F	343,510	47,443	483,402	826,912	49 2
Midwest	105,230	49,879	36 F	140,459	39,799	303,816	444,264	44 3
Northwest	141,748	117,423	63 F	473,323	219,791	1,412,828	1,632,142	46 0
Southwest	864,139	293,719	37 F	1,292,844	791,138	3,338,616	5,422,598	39 2
United	231,445	207,643	39 F	2,720,426	894,434	4,277,428	6,000,890	46 2
Western	142,442	77,014	54 S	355,442	151,363	343,192	4,966,548	32 1
<b>INTERNATIONAL</b>								
American	10,805	11,414	79 F	9,482	489	197,308	2,081,469	79 2
Boeing	4,420	8,203	68 S	22,487	124,718	1,236,466	1,361,184	41 4
Continental Atlantic	34,148	2,434	43 S	2,840	8,309	344,461	352,770	49 4
Delta	7,084	2,714	24 F	7,228	23,147	340,131	363,278	43 2
Eastern	34,103	80,000	61 F	17,412	146,444	1,426,990	1,573,434	43 20
Northwest	14,421	2,704	44 S	2,021	2,271	197,349	201,620	41 0
Southwest	11,201	7,761	30 F	2,028	1,344	123,868	125,202	39 2
United	15,839	27,496	40 F	1,367,499	17,114	1,648,540	1,665,654	39 4
Western	5,804	3,763	34 F	32,407	158,444	616,346	764,794	34 1
American	97,333	121,667	61 S	1,309,979	6,212,796	16,395,339	22,618,114	39 2
Boeing	99,834	112,289	64 S	436,247	4,193,716	16,377,821	20,967,753	33 2
Continental	30,825	114,363	78 F	1,857,976	1,107,683	16,346,468	18,561,130	39 2
Delta	11,801	14,770	63 S	61,364	803,447	2,402,407	3,287,218	44 2
Eastern	90,442	10,314	66 S	1,649,599	1,488,748	6,872,894	9,011,140	44 2
Northwest	9,230	34,256	64 S	1,649,599	1,488,748	6,872,894	9,011,140	39 2
United	4,302	4,754	44 S	10,419	39,560	746,974	786,544	47 4
<b>LOCAL SERVICE</b>								
Allegiance	40,941	7,476	41 S	12,984	33,219	39,425	729,360	44 4
Boeing	22,802	3,679	43 S	9,447	2,724	11,341	291,262	43 2
Continental	10,414	4,073	40 S	3,134	9,591	369,464	388,189	43 2
Delta	33,100	6,291	33 S	29,279	6,461	40,931	723,014	39 4
Eastern	16,428	3,181	34 S	1,844	17,691	304,619	322,310	34 2
Northwest	7,420	2,292	30 S	2,242	9,793	482,462	492,255	39 2
Southwest	76,207	10,343	40 S	43,549	30,714	1,493,444	1,567,707	41 40
United	42,897	7,156	39 S	15,508	34,294	27,942	746,893	41 2
Western	10,414	4,073	40 S	3,134	9,591	369,464	388,189	43 2
Boeing	39,494	6,697	38 S	10,889	11,142	1,494,444	1,516,636	39 2
Continental	16,428	3,181	34 S	1,844	17,691	304,619	322,310	34 2
Delta	34,980	6,481	31 S	31,839	40,919	694,462	725,381	37 2
United	51,721	7,415	41 S	14,710	4,404	17,718	731,698	41 40
<b>NAVIGATION</b>								
Alaska	21,118	3,474	34 F	5,367	7,527	394,798	402,325	32 3
Northwest	14,779	7,399	63 F	10,224	32,774	1,494,462	1,527,236	33 1
<b>CARDO LINE</b>								
American	271	1,345	69 F	42,460	194,273	344,695	549,468	49 2
Boeing	1,421	1,345	69 F	42,460	194,273	344,695	549,468	49 2
Continental	1,421	1,345	69 F	42,460	194,273	344,695	549,468	49 2
Delta	1,421	1,345	69 F	42,460	194,273	344,695	549,468	49 2
Eastern	1,421	1,345	69 F	42,460	194,273	344,695	549,468	49 2
Northwest	1,421	1,345	69 F	42,460	194,273	344,695	549,468	49 2
United	1,421	1,345	69 F	42,460	194,273	344,695	549,468	49 2
Western	1,421	1,345	69 F	42,460	194,273	344,695	549,468	49 2
<b>HELICOPTER LINE</b>								
Chicago	34,740	4,937	80 S	1,091	1,091	47,476	47,476	44 2
Los Angeles	3,932	9,932	80 S	2,448	2,448	2,448	2,448	44 2
New York	1,463	880	49 S	1,233	146	212	20,813	44 2
<b>ALASKA SERVICE</b>								
American	7,479	7,114	34 F	10,264	4,407	301,693	3,454,944	37 2
Boeing	1,418	599	30 F	3,403	3,142	76,493	80,635	41 4
Continental	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
Delta	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
Eastern	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
Northwest	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
United	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
Western	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
<b>NAVIGATION</b>								
Alaska	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
Continental	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
Delta	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
Eastern	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
Northwest	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
United	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4
Western	2,418	200	44 F	2,000	1,436	10,449	10,449	39 4

\* Figures interpolated from 10 through Apr 3 because of strike.  
 † Not available.  
 ‡ Figures from 10 through Apr 3 because of strike.



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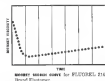
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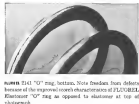


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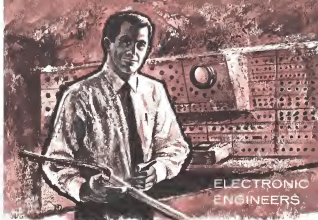
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continued discussion and coordination right up to the day of the actual launch itself.

The passage of time is a necessary condition of military satellite systems. When the military scenario becomes dependent on satellites for reconnaissance and intelligence, timely action by operational satellites will be needed in proportion to quick reaction by ballistic missile squadrons.

Missile satellites will be orbiting as the poles in a steady, carefully spaced stream. The failure of a single one will

leave a gap through which an attack could be launched without being detected. Operational units must identify the dead satellite on the first pass after the failure. The replacement satellite must be launched 90 min. later to fill the gap. A hold for technical or other reasons could be disastrous. Ideally, satellite handling vehicles would launch and transfer liquid propellants to make replacement possible before the completion of a single pass by the dead satellite.

U.S. ballistic missile, military



**PRACTICE** aerial pickup of a data capsule is made by a Fairchild C-119 after the capsule is ejected by the reconnaissance ship *Porpoise* in the Pacific. The plane then returns the capsule to Hickam AFB, Hawaii and capsule is dropped to the Satellite Test Center at Sunnyvale. Below capsule and its container are being refuel into the C-119.



satellite will be launched in precise and most comply with precision magazine standards. This can be a serious lesson in ready action because the booster must lift off the pad within a very few seconds of a preplanned time to hit the middle of the gap on the missile stream. If a serious accident, such as a tank must be removed from the danger area before launching, it will be another 90 min. before a replacement can be launched from that pad.

It was the pressure of time that then saw other factors that covered the Discoverer II capsule to be recovered by the Russians on Sparyngin's roller ship by the American ship of Hawaii (AW Ma 16, p. 25). The timer in the satellite which starts the optical separation and recovery sequence must be set by radio command during the low seconds the satellite is within range of the controlling station. This is done automatically when an operator points a series of buttons in the appropriate sequence.

In the Discoverer II test, the timer was set by command from the station at Kodiak, Alaska.

#### Control Sequence

The bottom line passed in the control sequence but a monitor showed that the command transmitted was incorrect. The possibility was known by the equipment designer and there it was to meet the time, but time was running out on the operator.

Under pressure, he forgot to push the "reset" button before retransmitting the command signal. The next code pulses added to the earlier ones set the timer for recovery over Sparyngin. The timer in the satellite functioned perfectly.

During the Discoverer program, the "Test Wing" contractors and supporting elements of the Pacific Missile Range have become progressively more active in tracking the vehicles during the launch phase and calculating the exact location of satellite orbits. This is a vital ability of warning and reconnaissance satellites and is done routinely. Their observations can be incorporated correctly only if their precise position during the observations are known.

#### Improvements Necessary

The improvement can be measured by the increasing accuracy of "acquisition messages" sent to tracking stations by the Satellite Control Room during the first pass. The acquisition messages tell each station the predicted time at which it will acquire contact with the satellite and the "look angle" at which tracking stations should be set to pick up early contact. First acquisition messages to Kodiak on Discoverer II were a minute off the actual time of acquisition.



**LOCKHEED** Agena satellite is loaded to a Thor automobile stage ballistic missile booster at Vandenberg AFB, Calif.

time. By the time of the Discoverer X and XI tests a year later the error had been cut to one second. Though the Discoverer re-entry capsule was not recovered, Ballistic Missile Defense officials say it was, in every other respect a perfect satellite.

#### Message Errors

For Samos and Midas, Test Wing officers would like to see acquisition messages enter in code of a second. The greater accuracy of command guidance used with the Atlas booster compared with the suboptimal guidance in Discoverer's Thor boosters should make this possible. Presently, word of Agena's total capabilities is used in command guidance for flight reconnaissance in the Vicer program. Douglas Aircraft Co. is expected to be working on industrial guidance for later Thor space boosters.

#### Semi-Photocast Control

The Satellite Test Center has the capability to control a number of satellites simultaneously. It will now be handling the Discoverer and Midas programs concurrently and in a few months the Samos program will begin. This multiple satellite capacity is necessary since early warning and reconnaissance systems will need a number of satellites on orbit at the same time. In the satellite program, the telephone is an extension for the information path, and by satellites can only be used if brought back to ground stations analyzed and translated into a comprehensible presentation that can be used

for defense, and information for use as a basis for decisions.

The system needed for accurate exploration of space can, in some extent, be compensated for only mission because they are not continuously repeated, make it not in passing and the color of the people making them can do much to make up for the shortcomings of non-human parts of the system.

The importance and specific nature of military missions impose different requirements.

- Boosters must be relatively inexpensive and recoverable.
- Control and information handling systems of the system must be improved.

### Samos Development Accelerated

As the U.S. Space advanced reconnaissance (optical) system probably will get accelerated development support as a highly definable "early-eye satellite," as a result of the critical international tension generated by the flight of the U-2 through the airspace of the Soviet Union.

Increasing pressure of satellites, both U.S. and Soviet, some of which have incorporated reconnaissance capabilities, has begun to undermine the facility of "cloud cover" if satellites are to be utilized by international law—and an international point has been reached as to the question of "recovered space" does any nation become involved.

Long headed as a "stealthy" base, Samos still recently has been given strong support and likely will get even more from a bigger ship, the WS-117L, built for Discoverer, Midas and Samos.

Operational status can be achieved in 1965—years before Midas—if the support and development program are continued on a high level. The system upon here has been ready for a considerable time.

Launched from Navy's Pt. Arguello pad, Samos will orbit in a north-south trajectory to cover the entire earth, which will rotate beneath its path. Estimates are that it will be in the reconnaissance orbit in reconnaissance orbit will give adequate, continuous surveillance of any national area.

From an operational altitude of between 500 and 550 mi., the satellite's high-resolution camera will be the ground station for teletransmission, as contained in a photograph and control post. Previous probes also will be used to cast and return a photographic film.

Replacement satellites will be required. The groups such to plug gaps in a satellite base. These gaps, passed on the Atlas-Agena vehicles, will have to be launched and injected into orbit with extreme precision to take the place of a "dead" satellite which, through equipment malfunction, ends back on intelligence.

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and operating without interruption. High reliability must be obtained to avoid the cost of more replacements and ensure availability in time of need. Components of the system must be streamlined and largely automatic for use by non-crews.

The 694th Test Wing was formed only six months ago. When Mada and Simon became operational systems, it will be necessary to fit the experience developed by the wing into combat study Air Force commands seeking the scientific capabilities. The data and the manner in which this will be done have not yet been chosen because funding is too uncertain to justify five plans.

The Test Wing includes the launch squadron at Vandenberg AFB and a Data Processing Squadron at Offutt AFB, Neb. Data from the Discoverer program is reduced by the completion of Lockheed Scientific Research Laboratory at Palo Alto, Calif. The testing squadron at Kofoid, Vandenberg, and Kofoid, Neb. Hovers are partly manned by the wing and civilian contractors. Employees of Lockheed and Philco will maintain Air Force men in a good way, but the latter is doing.

The 694th Test Wing, trained to recover descending Discoverer capsules in water, is a purely military assignment for its other flight operations in the program.

A northern tracking station is being set up at New Boston, N.H., outside

## Midsize Orbit

At Fowls, Maine satellite, a missile defense system system will orbit the earth in a north-south 160- to 200-mi circular path. Its six photographic reconnaissance cameras focus, ring infrared sensors to spot the heat of a hostile KSRV, provides in launch or flight, identifying the detection for a classification. In addition to a short range and mid-range path, the system has the base for an operational in defense capability, which means with reconnaissance, launch capability, or options of observation material in space.

Like Simon, a network of at least eight to 12 of the Midsize satellites will be required for full time early warning capability with backups to fill in for existing satellites now functioning in intermediate. Targeted for operational status after the beginning of 1961, Midsize will be launched by the Atlas-Agena vehicle. First Midsize vehicle's launch sequence is February from Cape Canaveral, Fla., via an orbital 284°N. The second experimental vehicle was launched last week. Third launch will be from Vandenberg, for north-south orbiting, or from Ft. Argonne, if the open road and there is only.



**AIR FORCE** has control of the Discoverer facilities Test Control Center machine data displayed on Vanguard screen during a Discoverer operation.

to get ready for Mada. Legally, a chain of Mada tracking sites should include some the surface agencies to fit contract.

The New Boston station could well be the first of these. One more Mada launch is scheduled to take place at Cape Canaveral before the program moves to its own pads at Naval Missile Facility, St. Augustine, adjacent to Vandenberg AFB.

The Argonne pads were not made for the start of the program, but will go into operation this fall. The other orbit scheduled for Mada cannot be ordered solely from Canaveral. Argonne is a facility at the Naval operations Pacific Missile Range (VW No. 9 p. 31).

Officers of the Satellite Test Wing report broadly on the support given to the Discoverer program by Pacific Missile Range. Two reconnaissance ships run capsule recovery ships and two Lockheed C-119s, early coming through as placed on orders by Pacific Missile Range at Satellite Test Center direction. A Discoverer tracking station is also operated at Pacific Missile Range headquarters. Ft. Mags.

## Instrumentation Ships

The reconnaissance ships are in capable of tracking the satellite because they have not enough money available to give them the necessary Polaris-capable, navigation equipment. They are also not equipped and are stationed under the points of which special sequences of events in the satellite must be tracked. The King County, a converted landing ship, is a vessel about 1,000 mi. downrange from Vandenberg to report the parachuting of the Agena first stage at advancing sequence velocity at 25,000 ft/sec and turning itself end-onward to prepare for the recovery sequence schedules 10

or 20 hours later. Trinity may be included in the work of King County to monitor its capabilities.

The other reconnaissance ship, the USS John F. Mearns, is stationed between Kofoid and Hovers to collect tele-metric information on scientific performance of the recovery sequence. Tele-metric equipment on both ships is operated by Lockheed employees, who use single antenna radio to communicate directly with each other, Vandenberg and Mags. Messages for the STC are relayed by Kofoid or Vandenberg over land lines.

The Satellite Test Wing and Pacific Missile Range both plan to capture accurate data on the recovery sequence ships. They will be in contact with each other and have been sent to the Pacific Missile Range. The wing will use the Lockheed C-119. One C-119 has already been used to bring back recovery ships such as data from the King County, entering the beach from a pole near the ship. Aircraft have been used by the Test Wing to carry some parts to the ship. Other C-119s will replace the ship. The C-119 will be the recovery sequence based at Hovers AFB, Hawaii.

The two Lockheed WV-2s and four Lockheed RC-117s replace early warning and control planes from the Midsize AFB, Hovers, are supposed to vector the recovery, aircraft to intercept the descending Discoverer capsule. They are stationed outside the perimeter of Hovers Area, where the capsule is intended to re-enter.

Gas causes the subsonic conversion of the recovery team. Accidents, taking up the airplanes, carry helicopters and frigates.



Strike test model of Saturn booster is trucked out of its assembly area at Huntsville, Ala. Ten other boosters will be built during the development program, and these will all be flight models. First flight test booster is current completion. Boosters will arrive in the train during their approximately 17-day trips from Huntsville to launch site at Cape Canaveral, Fla.

## Saturn System Incorporates Unique Design Details

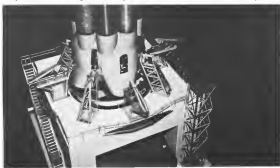


Hereonally moving hold-down device in background has four clamps which disengage and, as they travel back from Saturn, activate the tip-back hold-down clamp in foreground.

Saturn's guiding Rocketdyne H-1 main thrust engines (left at top of opposite page) differ from the four chamber engines in the center of the cluster only in that they have an igniter to exhaust the fuel-rich gases from the turbopump gas generator. These gases from the rocket engine are piped outside the start and exhausted in a high-velocity flow stream. Heat exchanger of the igniter is used to improve the efficiency of the propellant tank pressurization system by heating the cold gas from the storage bottles as it is piped into the tanks. Solid propellant start and stop sensors for the H-1 require one way to trigger each of these sequences and one neutral way. Solid propellant shutoffs are used to generate gas that will either start or stop the turbine during the turbopump. This simplified sensor is expected to greatly increase reliability of the Saturn booster. Start sensors on rocket engines now operational usually have a complicated series of pressure sensors, solenoid and electro-pneumatic valves to bring the engine up to full power. When the chamber pressure of the Saturn engines reaches 80% of their design value, the start of the hold-down mechanism fully begins, automatically. Thrust buildup with the H-1 engines is so rapid that they will be at almost full power by the time the release sequence is completed. The hold-down system consists of four clamps which are disengaged by moving back horizontally and then that rotate and flip back. Start activation between outboard guiding channel sensors at base of Saturn booster (right at top of opposite page) provides a base for start and permits a strong flow of gas to pass around the four main engines.



Mockup of Rocketdyne H-1 engine for Saturn at left is shown in the configuration used for guiding the control system. Full-scale mockup of Saturn base section and engine assembly is at right. Saturn launch stand model below shows hold-down clamps.





SWISS P.16 Mk. 3 strike fighter has up an array extension at Altstätten prior to takeoff. Payload is 6,625 lb. imp.

## P.16 Sales Sought Outside Switzerland

By David A. Anderson

Altkontin-Low-level ground-attack P.16 Mk. 3 strike fighter, designed specifically to a tough Swiss requirement for cross support, is a technically good airplane that got caught in political cross-fire.

Designed and developed by engineering and manufacturing firms at Flug- und Fahrzeugwerke AG, Altstätten, the P.16 now is being offered for sale or license production outside Switzerland, either in its present form or with design modifications including a new powerplant.

Present engine is the Bristol Siddeley, Sa. 7 Sapphire turbojet, rated at 11,800 lb. sea level static thrust. Development of the P.16 would be powered with a Rolls-Royce RB.146 rated at 15,500 lb. thrust as an alternate. Performance would be improved between 20 and 55% in takeoff, climb and acceleration.

Both Swiss and foreign pilots who have flown the P.16 report favorably on its handling characteristics, low speed performance, stability as a gun platform, and short field capability.

In its present form, it can take nearly 6,000 lb. of armament out of most low airfields with runway in sight, business a number of targets, turn in the air on a small radius and head home at 700 mph. speeds near the goal.

Two years ago, the plane was ordered into production by the Swiss govern-



P.16 ARMAMENT views consist of four engine bays, 24 air-to-ground rockets and roommates for two 30 mm. cannons.

ment as a replacement for the country's aging de Havilland Vampire and Venom. Within one week after the order was placed, the third prototype airplane was lost when the pilot ejected safely in a landing approach following hydraulic system trouble. The new order was suspended until after the official investigation of the accident, and two months later was canceled (AV June 9, 1978, p. 18).

Official reason for the cancellation was that the hydraulic system was faulty, would have to be completely redesigned and would delay production of the airplane to a point where the order would not be worthwhile. But unofficial observers believed there was still do-that-the (accident) was a convenient excuse to drop an airplane for political reasons rather than on technical grounds.

But against the background of specific Swiss requirements, the P.16 still seems the country's best bet for many of the operational and design plans being developed. The P.16 Mk. 3 remains a single-engine, single-seat airplane on the 21,000 lb. weight category, with maximum speed just under 700 mph. At cruise altitudes, it can take off in 1,500 ft., and land in 1,000 ft. on a sea level field. At overload weights up to about 25,000 lb., it can take off and land on a minimum support runway 7,000 ft. above sea level using about one mile of runway.

The airplane will not spin. It can be flown under control as a fully stalled attitude, at vertical descent rates up to 123 fpm. It has never shown stalled delivery characteristics, and Mach 2 is the design number for certain airplanes.

### Cancellation Remained

In spite of the company's protest that the hydraulic system was sound, and the results of an investigation made by an impartial team of British engineers from Royal Aircraft Establishment Farnborough which cleared the system and the company of blame, the cancellation stuck. Studies were begun to determine the best airplane available outside Switzerland for purchase or license production.

Two years later, the Swiss air force, technicians are still studying the problem, and still must make a decision on what will replace the ever-elusive Vampire and Venom. Costs have risen,

delivery dates have stretched, and Mach 2 is the design number for certain airplanes.

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wing drops either at high speed as landing, takeoff, straight and level, or in a tight turn.

### Hit Average

The average at high as 80% have been obtained on a 10 sq. ft. target at distances up to 5,000 ft., and plans for the primary and rocket firing runs were laid in their place as a stable platform.

It has been there through a course flight-test program in a Swiss reserve military pilot. He had a total of 900 hr. flight test, and began the test routine after five familiarization flights from a 1,000-ft. runway.

Growth has been done out of the airplane. Zero-launch or rocket-assisted takeoff capability, airframe gear, increased loads, short takeoff and increased internal fuel capacity could be installed as modifications by the curing air planes. Design tooling for production additional design developments could be accomplished by the P.16, after-burner installation, liquid propellant rocket engine, or a 70-foot configuration test.

### Design Requirement

Strength and design of the airplane was based on British Design Requirement AP 970 for military aircraft. The computer used Swiss American or French design criteria when they were bought than those of AP 970. Critical design conditions for the structure was a speed of Mach 1 at an altitude of 7,360 ft. with a load factor of 5.5. Ultimate



P.16 has leading edge flaps, port-lap flaps, trailing edge flaps and drooped ailerons.



P.16 Mk. 3 Strike Fighter	
Specifications	
Overall length	46.8 ft.
Wingspan	36.8 ft.
Height	14.8 ft.
Wing area	313 sq. ft.
Wing at quarter-chord	30 deg.
Internal fuel	800 gal.
Maximum fuel, including external tanks	900 gal.
Empty weight	15,000 lb.
Normal gross weight	22,450 lb.
Overload gross weight	25,000 lb.
Maximum landing weight	19,000 lb.

# MOS

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requirements  
are determined.

**INVENTORY  
MANAGEMENT**  
Optimize inventory  
levels and establish  
MRO (Maintenance,  
Repair and Supplies)  
Purchase orders and  
manufacturing orders  
are created.

**SCHEDULING**  
Based on customer  
requirements and  
available facilities,  
a manufacturing plan  
is produced.

**DISPATCHING**  
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are established to  
implement the  
manufacturing plan.  
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to meet engineering and  
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integrated in control  
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BALANCED DATA PROCESSING



SWISS P.16's tactical radius at different takeoff weights is plotted at left; ground attack against a tank is plotted at right

load figure are 12,75g positive and 1g negative.

After the loss of the third prototype and the investigation and consultation that followed, Defense Minister Paul Cherdron, now president of Switzerland, publicly accused the company of not following design requirements, not meeting British structural criteria and not following military techniques of design of the design.

FFA officially denied these charges (AW July 7, 1953, p. 39), and it had informed the technical section of design, and then asked for a full-scale investigation of the whole affair. The pilot was that the British Ministry of Supply was asked to send a group of specialists from RAE-Farnborough to make an investigation.

The British team went through the whole story of the accident, and then found official cleared the company of any technical blame in working design requirements for the hydraulic system.

FFA engineers built a full-scale hydraulic system test rig and, after hundreds of cycling tests and minute investigations of the variable wreckage, proved together the probable sequence of events that led to the loss of the airplane.

**Physical Phenomena**

It boiled down to two critical failures and two human errors. The fall of these occurring in sequence were very few. Coupled with these was a physical phenomenon which had not been completely understood before the P.16 crash, either by Swiss engineers working with the best available data, or by the French, from whom much of the hydraulic system data came.

The critical failure was in a coupling on the downstream side of the main hydraulic system supply tank. Its failure allowed air to be pumped into the system, and the hydraulic fluid absorbed much more of that air than any

oil/air fluid had indicated. Foaming of hydraulic oil in and was a known phenomenon, but the percentage of foaming was indicated as scarcely less than 10% of the hydraulic system available to the Swiss engineers. That was not the case in fact, the percentage of foaming was very high.

The last human error occurred in the ground crew, which didn't realize that the hydraulic tank was full of foam instead of liquid. The crew could see the level of what was thought to be fluid, well above the visual inspection window on the side of the tank, and the crew assumed that it was better for the tank to be over-filled than under-filled. The high level was not reported, and in three weeks from the system after several flights with the cracked coupling

**Final Flight**

On the final flight, the hydraulic system pressure finally dropped below the cutoff point because of the foaming. It happened during the final approach to the field. Normally if there had been a hydraulic system failure, the pilot could have observed the pressure manually if the airplane had been grounded for the particular flight configuration.

But that was the second human error. The pilot had been making high speed runs and the airplane was trimmed to be nose-high.

He had also returned the airplane for the approach, and was holding the attitude of the P.16 with the stick deflected.

When the hydraulic system pressure dropped below the normal value due to foaming, the stick went back the rear and the standby system, putting the airplane on manual control, the pilot could not hold the stick back. The stick was yanked forward to full deflection out of his hands. Left with no time to trim, and not enough strength to fly the airplane manually, the pilot ejected safely

and the P.16 crashed into the lake off the end of the runway.

That final accident, with its triple-laden chain of error, spelled the end of the P.16 for the Swiss.

**New Company**

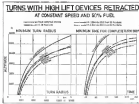
With government support withdrawn, a dark cloud of suspicion hanging over the company, FFA's aircraft became looked upon as dead. The engineers believed in the airplane, and felt that they had to clear it and themselves of the charges made against it.

They formed a new company, completely independent of FFA financially, called AG, the Flugzeugwerke der Schweiz, with the specific objective of completing the flight test and development of the airplane (AW Sept. 7, 1953, p. 28). The program was started by military pilot John Buehl after training of five flights in the fourth prototype airplane, Buehl, like most of his Swiss counterparts, is not a professional military pilot, and serves as a wing commander with the Swiss Air Force, getting a commission of about 70 per cent from his salary as a military pilot.

Part of Buehl's program was a series of eight or nine ground tests only, on high-speed, low-speed and landing flight, and in the landing configuration. He reported no difficulties in flying the airplane under full manual control under any of the test conditions.

Since then, the P.16 has been flown by other pilots, including Willem P. Lee, Jr., once president in charge of Lear's European operations, Lear, an ex-military pilot with about 1,000 hr per year, mostly in light-turboprop, and the chief engineer to check out his company's equipment on the P.16. During his flight, he reached the highest Mach number (1.01) and the highest indicated airspeed under the ground (745 mph) achieved during the airplane's test program.

"What really impressed me," he



HIGH LIFT DEVICES on the P.16 include Fowler-type leading edge flaps and tailplane leading edge flaps with 120-deg deflection

and, "was to be able to check out in a sec, get altitude on a 3,600-ft runway."

The P.16 never needed more than 2,000 ft of the runway for takeoff, or more than 1,000 ft for landing, he said. This is parallel experience to that of other pilots who have flown the P.16.

**Pilots Impressed**

The short-field performance, coupled with the P.16's stability in a gust (platform and its turning capability) have impressed both pilots and observers. These capabilities were one of the major design goals of the engineering design team headed by Dr. Hans J. Strider.

Mean aerodynamic device of the P.16 is in wing, a design compromise aimed at getting the best possible high speed and low-speed characteristics on a limited span structural strength. These combined considerations dictated the final choice of wing aspect ratio of 4.75, constant thickness ratio of 8.5, hollow leading edge and trailing edge flaps, permanent tip tanks giving no roll and pitch effect, no external fuel, no controls, and an ultimate load factor of 12.75.

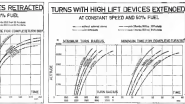
These characteristics added up to a remarkable low-speed, turning performance, and very slow stall and landing rate. Practical lift coefficients in landing configuration approach a value of two.

**Fowler Flaps**

Trailing edge flaps are Fowler-type opening about half the wing, and raising an eight-degree angle to a maximum deflection of 45 deg. Flap span extends right across the leading edge.

Additional leading-edge flap comes from drooping the airframe through 15 deg., automatically dropping this hinge line to account for the dip.

Fowler-type leading edge flap with a deflection of 120 deg. is fitted to the P.16 flap tip in a constant-chord section of the wing section, made



HIGH LIFT DEVICES on the P.16 include Fowler-type leading edge flaps and tailplane leading edge flaps with 120-deg deflection

of a magnesium-aluminum casting, and deflected down and forward to the 120-deg position by four hydraulic rods.

Best payment for such flaps—distinct from slots and dampers—was made during World War II in German aerodynamic Dr. Kruger of Göttingen University.

FFA's studies of the flap began in 1947 on a standard of level-towed test load, and was incorporated into the P.16 design. They were first flown on a prototype airplane in April 1953, in what the Swiss say was the first actual use of the leading edge flap on a full-scale airplane.

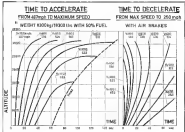
This particular modification increases the lift coefficient of the wing by about 50-60%, say experts engineers. Structural design of the wing was complicated by the decision not to carry fuel or to make any large external in-flight wing design is a multiple-loss

lowest wing eight normal shock waves and covered in narrow tapered skin. Fowler-type flaps had a corrugated sandwich wing structure, but the prediction the tapered skin is a better solution.

**Wing Leading Edge**

Wing leading edge, including the flap, is made of a magnesium-aluminum casting extending right through the fuselage, and acting as part of the jet main stressed structure. This leading edge casting carries leading edge flap hinges and their operating gear, serves control rods and tip tank attachment points.

The only element of use was in the lower outer section extending the load, staggered short, and as such is not main structure weight. Two cast spines were spun from the front and rear members of the outboard, and there are



BRACING EFFECT of the packaged speed brakes on the P.16 is depicted at right

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smaller,  
more efficient...

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also glass, have cut ribs on each wing panel.

Flaps and ailerons are lowered for landing configuration by hand-driven squibs. Flight bolts attach the wing to the fuselage.

Fuselage structure of the wing is very stiff. During strength tests in ultimate load factor of 12.75 wing deflection was measured at 11.4 in., and after load is off, the residual deformation was 8.1 in. Under conditions of aerodynamic pullout and a loading of 141% of the ultimate load (1.9 g), wing behavior was purely elastic.

### Fatigue Investigation

Detailed fatigue investigations were done for airframe points where the high stresses were found during static load tests. As a result of continuous fatigue evaluation during the development of the airplane, P-16 suggests below the F-16 can then very high fatigue life.

They attribute this to a design plus fatigue which was based on a constant application of stress-strain techniques involving stress concentration and designing for high static reserve factors with a positive margin between actual and allowable stress throughout the structure.

Driver structure of the fuselage and tail surfaces is conventional, but the air frame controls are faired and cut and cut with very thin aluminum alloy skin.

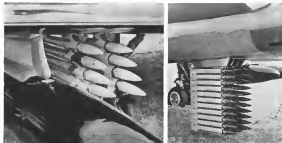
### Low-Pressure Tests

Loading gear is the Downey liquid spring type. Both nose and main gear have tires which are mounted on the nose wheel gear is 75 psi, and on the main gear is 97 psi. But the use of the double wheel load gear is lowered contact pressure roughly equivalent to low pressure test (in the order of 48 psi). There is the force advantage of having double loading capacity, available with disk loading on both wheels.

P-16 made two takeoff tests on the wet gun test strips at 1000 ft. The first test was at a gross weight of 31,500 lb., slightly over its normal takeoff weight. The test was not permitted in the P-16 which had the standard 30-in. main wheel. The test was made with the standard 30-in. main wheel. The test was made with the standard 30-in. main wheel. The test was made with the standard 30-in. main wheel.

Takeoff distance under the test conditions was about 3,300 ft., but other tests on dry grass fields showed figures as low as 2,400 ft. for takeoff and as low as 1,400 ft. for landing distance using the basic chart. Without the basic chart, landing run was 2,700 ft. in average.

Armament of the P-16 is placed around the perimeter of the gun and rocket. Basic installation is a pair of 30-mm Hispano-Suiza HS 525 on each cannon with a muzzle velocity of about



**WING ROCKETS** are mounted on the P-16 in groups of four (left), with only the top rocket around the wing and the mid rocket(s) interlocked with the fuselage. What appears to be forward fuselage is the main stabilizing fin for the rockets, mounted on a slip ring. The body of the rocket increases slightly in diameter toward the nose so that when the rocket is fired it moves forward through the slip ring and pulls the fin assembly on the air body. Technique is designed to achieve dispersion. Right rocket launchers (right) hold 44 M80s Type 1000 or ground rockets, 2.05 in. in dia. Back of shown body extended for loading; for firing, only two rockets protrude at an angle below the fuselage, and one of them is being fired at that moment.

3,600 ft/s. Rate of fire is 1,000 rounds per minute, and there are 125 rounds per gun in the P-16.

A large variety of additional armament can be fitted to the P-16, depending on the target and mission requirements.

Alternate installation combining rockets, bombs, or fuel tanks can be added to the main 30-mm cannon up to a maximum overload armament weight of 5,700 lb., one of the lowest loads listed in a single-engine jet airplane.

Major component of the loading power of the P-16 is a 5500-watt automatic rocket launcher installed in the belly. Launcher and rockets are made by the French firm of Matra. Rockets are designed following Type 1300, and measure 68 mm (about 2.7 in.) in diameter. Rockets are loaded in a network of four rows of 11 rounds each.

### Rocket Firing

For firing, the rockets are triggered automatically below the fuselage, extending down the depth of two rockets below the slip ring. This distance is maintained during the firing sequence, the bottom round is fired, and then the whole launcher drops down one rocket diameter, so that the next low round is exposed and fired. Warheads for these air-to-ground rockets can be either explosive or hollow-charge for tank-busting.

The wings carry 12 attachment points for the rockets, and the main stabilizing fin for the rockets, mounted on a slip ring. The body of the rocket increases slightly in diameter toward the nose so that when the rocket is fired it moves forward through the slip ring and pulls the fin assembly on the air body. Technique is designed to achieve dispersion. Right rocket launchers (right) hold 44 M80s Type 1000 or ground rockets, 2.05 in. in dia. Back of shown body extended for loading; for firing, only two rockets protrude at an angle below the fuselage, and one of them is being fired at that moment.

from that can be used to long clusters of four Hispano-Suiza HS 525 air-to-ground rugged rockets. Three rounds, available either with hollow charge or explosive warheads, measure 80 mm (about 3.1 in.) diameter.

Dispersion of these rockets has been referred to in a figure comparable to that of cannon—five feet per second (or 150 ft/s) in terms of the launching technique.

The rockets appear to have forward fins instead of aft stabilizer surfaces. Actually, these "forward" surfaces are the aft fins, mounted on a ring whose diameter is just a little larger than the diameter of the rocket body forward of the tail. When the rocket is fired, it moves forward through the ring and is attached by the ring which acts as its diameter inhibitor launcher. As the rocket moves forward, it picks up the projected tail assembly because the body diameter of the round increases slightly toward the tail. The fin assembly goes on the body as the rocket leaves the cluster.

Fuel fin has a slot over the trailing edge which releases fuel as the fin is fired along edge of the rocket above it in the cluster, forming a rapid stream of four inches when they are mounted on the launch point.

In addition to the 12 rocket launch points, there are four launch rails fixed under the wings, making it possible for the P-16 to carry a wide variety of external stores in addition to the rockets.

Standard loads could be made up from examples on combinations of 418, 1,000 or 2,000 lb. bombs, 100-gal. napalm bombs, rocket containers holding 19 or 31 M80s 55-mm rounds, housing machine gunned bombs, 100-gal. auxiliary fuel tanks, or combined 75-gal. auxiliary tanks, giving maximum capacity.

### Normal Armament

Normal armament installation weight runs from the 180 lb. of the main cannon installation to a maximum of 1,500 lb. Overload operation starts with armament weighing 4,940 lb. and goes to maximum weapon weight of 5,700 lb.

Fuel system of the P-16 is simple, and involves three tanks, the two wing tanks and a fuselage collector tank. Compressed air feeds the fuel from the 213-gal. tip tanks to the fuselage collector tank which holds 151 gal. Fuel is then pumped electrically from the collector tank to the engine pump which in turn feeds the high-pressure fuel nozzles.

Refueling point is a single connection on the lower fuselage side, it can be fed with fuel pressure between 15 and 45 psi. Fuel can be generated from hoses in the tip tank, it takes about one minute to dump the entire supply.

Hydraulic system is the same as in the basic machine, and only minor changes were of basic design—there have been no changes. The main hydraulic fluid tank is divided into two compartments



# AVIONICS



**AERIAL VIEW** of first British Mobile Early Warning System, to go into operation this fall, shows site layout at Thule, Greenland. In front of each of the four giant detection radar antennas (1) is a pipe space-type scanner building. Radar transmitters and receivers are housed in two buildings (2) as well as in building which houses tactical display and data processing equipment (3). Service buildings (4) are at extreme right. All buildings are constructed by 6,000 ft. progress.

## First BMEWS Nears Operational Status

By Philip J. Kline

Thule, Greenland—Air Force's first British Mobile Early Warning System (BMEWS) site, the largest, most complex military electronic facility ever constructed, is reported to become operational this fall, only 24 years after first contracts were awarded.

Four powerful detection radars of the BMEWS are here, located 900 mi from the North Pole and roughly midway between New York and Moscow, will be able to probe several thousand miles to give Strategic Air Command

bombers and missiles at least 15 min warning of a mass ballistic missile attack.

First operational test of the BMEWS are here is expected to use radar alert facilities as targets. Second of the three planned BMEWS sites, at Chuk, Alaska, is scheduled for operation in the summer of 1961, with the third site in Britain to follow shortly afterward.

The four giant detection radar antennas here, each standing 165 ft high and measuring 400 ft long, larger than a football playing field, are themselves almost dwarfed by the large, cone-

shaped BMEWS transmission shell which extends more than a mile in length. The installation is situated atop a cliff which overlooks a fjord and the Greenland coast.

### Metals Passageway

An enclosed metal passageway, large enough to accommodate helicopter and trucks, connects the four antenna scanner buildings, two radar transmitter/receiver buildings, a tactical control and data processing building and several service buildings. More than 21 mi of huge walkways, resembling

large heating ducts, lead one side of the passageway to carry power from the radio transmission to the scanner buildings.

Originally the BMEWS units in Greenland and Alaska were to have AN/FPS-49 tracking radar in addition to the AN/FPS-90 detection radar (AW Feb 23, 1958, p 19). The FPS-49 is produced by Radio Corp. of America, which also is the BMEWS system manager; the FPS-90 is produced by General Electric's Heavy Military Electronics Department.

After the program was under way in early 1958, Air Force took a close, hard look at original cost estimates and decided that originally planned facilities could not be obtained within budgetary limits. Air Force therefore decided to forgo the FPS-49 tracking radar at least initially.

However, foundations and polestars have been constructed here so that tracking radar can be added later if desirable and if funds permit. Cost of adding three tracking radar here and two at the Alaska BMEWS site is estimated at around \$75-100 million.

### British Base

The first British-U.S. BMEWS installation to be made at Thule will use only the RCA tracking radar. Only the RCA-developed radar set now planned. Estimates to use the RCA radar for both detection and tracking is based in part on the fact that Western Europe possesses a relatively small target area and that IRBM rather than ICBMs represent the major threat.

Thus, broad angle detection radar are not required.

Total cost of the BMEWS site here is estimated at about \$500 million. Slightly smaller installation in Alaska, with three detection radars, will cost about \$125 million. Site in Britain will run about \$115 million. British will pay for facilities construction costs, estimated at about \$15 million, with the U.S. providing radar and associated equipment. Installation will be operated by Royal Air Force and USAF. Britain will pay annual operating costs; the U.S. will supply spare parts.

A few years ago, it would have been considered technically impossible to design a radar with a detection range of more than 2,000 mi against a small target the size of a missile warhead. Yet today, General Electric engineers on the site here show no doubts that the FPS-90 can accomplish detection ranges which would have been ascribable a few years ago.

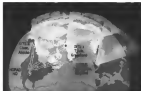
This confidence is born of experience with General Electric's predecessor equipment, such as the FPS-47 installed in Turkey and a later version installed in Trinidad to track missile fuel



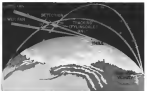
**AN/FPS-90** first British Mobile Early Warning System (BMEWS) site in Greenland will go into operation this fall only two years after construction was started near Thule AFB, approximately 900 mi from the North Pole and roughly midway between New York and Moscow. Much of the construction was carried out during long Arctic night.



**THREE FOREIGN** tracking radar antennas, produced by Goodyear Aircraft, with 16-ft diameter dish, will be installed at BMEWS site in Britain. Antenna contract would be awarded to write \$110k of up work. The AN/FPS-49 tracking radar, made by RCA, may also be installed at BMEWS sites in Greenland and Alaska if funds permit.



**DETECTION COVERAGE** of three proposed BMEWS sites in Greenland, Alaska and Britain together with the dual starved communication circuits which link them with North American Air Defense Command and Strategic Air Command Headquarters are shown in detail at left. Thule BMEWS site lies 900 mi from the North Pole and roughly midway between New York and Moscow. It is 22 mi from the maximum energy trajectory G3 dog's attacking New York (right). Dual radar beams enable BMEWS to tell whether object is on RCN, also its launch and impact points.





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**THIRD BMEWS site, in Britain, will employ three AN/SPS-49 tracking radars to be used both for detection and tracking**

from the Atlantic Missile Test Center. The FFS-50 operates in the lower portion of the ultrahigh frequency band.

Each radar antenna provides two beams which simultaneously scan in azimuth, utilizing a pipe organ type feed array and large scanning reflector. One beam has an elevation angle relative to the horizon of 2-5 deg, the other an elevation angle of 6-10 deg. The four antennas at this site collectively produce a complete radar coverage of about 150 deg.

### Time Interval

By measuring the time interval between target reflections of the two beams, target radial velocity by means of Doppler shift, and using one cultural method of determining target bearing and range, BMEWS computers obtain sufficient information to determine whether the target is following a ballistic trajectory or whether it is a satellite or rocket.

If the target shows warhead characteristics, computers supplied by Systems Electric, can also compute its launch and impact area.

The eight radar beams are powered by a total of 24 solar transmitters, each employing ultraviolet tubes rated as "auxiliary equipment" peak power. By means of switches operable from the tactical control center, several transmitters can be paralleled to increase the power output of one antenna beam.

Recently developed low-noise parametric amplifiers were not used in the FFS-50 system because their design had to be frozen before the parametric amplifiers had passed their practicality. The addition of such amplifiers, evaluating actively noise out, should make it possible to extend the range of BMEWS radars.

### No Radar Scopes

Because the power level of the received signal (echo) from a nose cone at a range of several thousand miles is only a trillionth-of-a-watt, it is too small to be distinguishable from background noise in a human operator's display on a conventional radar scope.

The extremely weak signal must be integrated and otherwise enhanced, then

refined by computer for characteristics which mark it as a signal return as distinguished from random noise, or noise from natural phenomena such as meteor trails. Such enhancement and analysis must be performed at speeds far in excess of the capability of human operators.

BMEWS does not, therefore, use conventional cathode ray tube type display. Target data from digital data processing equipment is displayed on tube boards and consoles, array color, illuminated panels which are easy to read and unobscured.

Information on ballistic events, target, their calculated launch and impact area, together with a status report on the coordination and performance of radar equipment, is displayed simultaneously at the BMEWS site and at North American Air Defense Command

(NORAD) and Strategic Air Command Headquarters.

The display includes a statistical measure of the "confidence level" of the target data displayed, based on the quality of signals, performance of radar sets, atmospheric conditions and other factors.

### Digital Data

Data for display at NORAD and SAC Headquarters is transmitted in digital form to two completely separate communication systems. Western Electric or a BMEWS prime contractor for near word communications. One is a submarine cable, actually two cables sep-

arated by a moderate distance, normally laid in Alaska for the BMEWS site. The other is a high power AN/FRC-47 tropospheric scatter system which links Tule to the Cape Deer terminals of the DEW Line, which in turn has near word tropo scatter circuits back to continental Canadian telephone circuits. The FRC-47 is a quadrangle circuit system, employing dual antennas and both horizontal and vertical polarized beam antennas to arrive electronic shadows.

The tactical display, message from BMEWS site is transmitted in digital form, using audio tone modulation. This message field consists of 61 bits, in which are added another 15 bits for er-

## BMEWS Contractors

Nearly 1,000 companies participated in the USAF's Ballistic Missile Early Warning System (BMEWS) program, providing some 20 million man-hours of effort to the nation's largest industrial organization. Major contractors and their responsibilities include:

- Radio Corp. of America: prime contractor and system manager. RCA also supplies for AN/SPS-49 tracking radar and automatic checkout and monitoring equipment for radar system.
- Western Electric Co.: prime contractor, responsible for various electronic systems from BMEWS site.
- General Electric: subcontractor, responsible for AN/SPS-50 detection radar.
- Systems Electronic: subcontractor, is responsible for automatic data processing, system, including equipment for converting radar output from analog to digital form and digital computers (now obtained by International Business Machines Corp.) for analyzing target trajectory and threat.
- General Electric: subcontractor, responsible for building 50 ft pedestal and 140,000 pounds portable antenna used in AN/SPS-49 tracking radar in both in stations that receive antennas.
- Principal subcontractors to General Electric on its AN/SPS-50 detection radar include:
  - Continental Electronic Manufacturing Co.: radar transmitter.
  - D. S. Kennedy & Co.: antennas.
  - General Electric Corp.: antenna pedestal.
  - Ford-McCullough and Varco: antenna structure manufacturing fabric.

RCA, which accounts approximately 60% of the total BMEWS contract has been subcontracted and that approximately 50% of the total expenditures have gone to small business firms.

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USS STRUX is an ultra-high-strength alloy steel, developed by United States Steel, for use in aircraft. It can be forged, machined and heat-treated to develop strengths in the 280,000 to 300,000 psi range with adequate toughness. Compared with SAE 4340, frequently used in landing gear components, STRUX has about 7% more strength and, as proved by landing gear makers, can reduce weight by a comparable amount.

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The primary STRUX components in the Vigilante's main landing gear include the outer cylinder, inner cylinder (rotors) and fork, and a trimmer. The nose landing gear uses an inner cylinder and a fork made of STRUX. Engineers tested every facet of STRUX's mechanical properties and workability before specifying it for the AJL landing gear. Each main gear must withstand shock loads that can run well over 100,000 pounds.

U. S. Steel sells Strux in the hot rolled or annealed condition in a full range of bar sizes, in blooms and billets up to 157 1/2 inches square or in flat rolled products as required.

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The Navy's new AJL Vigilante, produced by North American Aviation, Inc. Landing gears are built by Borealis Products Co., Borealis Aerial Co. — — — — —



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**TRANSMITTERS** for high-power BMEWS units, contained in cabinet shown above type segment-level power to transmit aircraft through large weather radar. Elaborate switching system permits several transmitters to be selected for increased range or to be ordered to other stations in the event their transmitters malfunction.

or detection using triple interrelated pairs of coils.

At 1,200 air intervals along the two reversed communication paths from BMEWS, the messages are automatically subjected to an error (parity) check. In addition, when the detected messages arrive at Nead over the two circuits, they

are compared. If there is no discrepancy, the message goes to the display boards. If there is a difference between the two messages, the BMEWS site is automatically requested to retransmit the message.

To continuously monitor and exercise these vital narrow-band communication circuits during periods when there are no track tactical messages to be transmitted, automatic checkout equipment at the BMEWS site will transmit test messages at the rate of eight per second. If only one correct test message per second is received, an amber alert sounds; if three correct messages in the past that only four correct test messages per second or less are received, that and three sounds to alert operating and maintenance personnel.

## Phone Circuits

In addition to the data link circuits, there are telephone and teletype means which can be employed for transmitting tactical data in an emergency.

When the DEW Line was built, stations with rotating surveillance radars were placed only 500 air apart so that if one station had to shut down, adjacent stations could cover its sector. Because of the extremely high cost of a BMEWS installation, such backup is not feasible.

Instead, RCA and its subcontractors have used even more elaborate techniques to build that backup capability into each BMEWS site so that round-the-clock operations are assured.

Shutting off the radars reduces the risk, whenever feasible, redundancy has been designed into the equipment. For example, the stable local oscillator in each of the transmitter/receiver buildings is provided in duplicate. Both equipments are operated continuously although only

one of them is "on-the-line." Built-in monitoring circuits check the performance of both equipments. If there is significant degradation or failure of the entire equipment, it is automatically switched off the line and the other equipment is connected into service. The operational status of all equipments in the transmitter/receiver building is shown on a console in the building's control room.

The Master Inhibit Indicator Set (MIPS), which involves radar data to determine type of target, aspect area and launch time of it is a worked, and total number of warheads, employs two IBM 7090 solid-state digital computers. The two computers constantly solve the same problems; their comparison solution is to use them as electrical logic transmitting north to center displays. In addition, each computer periodically subjects itself to a test problem, whose answer is known to check all of its internal elements. If a machine fails to pass the test problem, a lead alarm sounds to alert the operator.

Error repair equipment contains its own built-in monitoring which continuously checks critical voltages, main buses or other operating parameters to detect the first signs of deterioration in performance or failure. The operating status of each equipment in the transmitter/receiver buildings is indicated in the individual building's control room.

In addition, there is a central overall system monitor which displays the operating status of every element in the entire site. This room is adjoining the tactical control room in the center building which houses data processing equipment, plus lower radar transmitter and receiver.

## Checkout Development

RCA, in addition to its various main agreement and PPS-IV responsibilities, developed the software, monitoring and checkout equipment for the overall system. In addition to the overall status performance monitoring in the central control room, the RCA equipment also provides automated ballistic missile objects, programmed on magnetic tape, which check the performance of the complete system output for the system. The test program input to the system is introduced at the RT level by probes in the system's watchdog.

Since idea of the complexity of the overall BMEWS installation here can be gleaned from figures on the total number of basic components used in the system. These include:

- 115,000 transistors
- 15,000 vacuum tubes
- 250,000 capacitors
- 1 million resistors
- 160 mi of cables

Which makes maintenance a de-



**ANTENNA** for General Electric AN/FPS-50 detection radar stands 151 ft high, 400 ft wide, larger than a football playing field. (For relative size, note man on catwalk.) Four of this 350-foot antenna, produced by D. S. Kennedy & Co., are installed at Thule BMEWS site. Antenna is mounted on a circular base, pivoting in horizontal plane, pivoting in vertical plane. Automatic checkout system, developed by RCA, continuously monitors and tests performance of entire BMEWS facility, including both when a malfunction occurs. Console shown below gives complete readout on operating status of every major element in the BMEWS site, including vital narrow-band communication circuits to U.S.



## Where you must have actuator reliability... look to Airborne



Detail of DEW Line Radar Extension Secondary Vehicle (DERV) shows location of Airborne actuator used to extend and retract extension package. Dimensions shown—40 to 1807. All holes to 200 unless noted. Weight of actuator: 2.2 lb.

Among the more critical of recent Airborne actuator applications is that on the National Aeronautics and Space Administration's NERV vehicle, where a linear actuator is required to extend and retract a motor extension package. In fact, seven of the vehicle's mission—study of the lower Van Allen radiation belt—depends to no little extent on reliable functioning of this one component alone.

In initial trials, the NERV will be carried in an 106-mile altitude by Atlas D-8 rockets. The flight program calls for emerging the antenna at 120 miles up, thereby opening the shutter and telescoping the extension package out from the foot of the nose cone. This

condition is maintained until the vehicle is within 200 miles of the ground on the way down, at which point the actuator extends the antenna package, closing the shutter.

Necessarily also in this application are some of the same component's quality assurance items, including acceleration to 125 g, several pressure levels of 160-din/min momentary and shock loading of 30 g.

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total, a series of tests (repeated on punched cards or tape) can be used to track down and isolate the fault to a major subsystem.

### Systems Compared

Because the DEW Line and BMEWS both are designed for early warning and both are Arctic installations, it is interesting to compare the two, though they are complementary. The 5500-million-ton building the BMEWS sits here in Thule is slightly less than the cost of building the complete DEW Line, with its nearly 60 stations stretching across 5,000 mi.

However, while the bulk of the DEW Line cost went for the construction of facilities rather than for radar and communications components, the reverse is true for BMEWS. Because the majority of DEW Line stations were built at isolated locations, it was necessary to construct landing strips, water supplies, roads and other service facilities at each site. The BMEWS site here, located only 12 mi from the main Thule Air Force base, would require many of the existing facilities.

The 700 personnel who will be required to operate the BMEWS site have an immediate check here as about 100 less than the number required man the DEW Line. However, BMEWS personnel will be housed and fed (except for mid-day meals) at Thule AFB and the base also will provide many service facilities. DEW Line stations must provide all such services and facilities themselves. (BMEWS site will contain emergency dormitory and eating facilities when housing "white-outs," or "phases," produced by 100 mph, icy winds that blow over the icecap and strand personnel at the site.)

In terms of cost and operating personnel, the single BMEWS site here is roughly equivalent to the 60 stations DEW Line, which gives an indication of the magnitude of the undertaking.

### Civilian Personnel

BCA will provide civilian personnel to operate the BMEWS site here and in Alaska, at least for the initial year and possibly longer. Total annual operating cost for this site is estimated at \$500 million, slightly less than the cost of operating the DEW Line which is covered only by Federal Electric Corp. under USAF contract.

If location of BMEWS site was existing air bases used some of the construction problems, compared with DEW Line construction, there was many new problems peculiar to BMEWS. For example, the huge 1,500-ton radar antenna had to be designed, and installed, in isolated woods with velocities of up to 100 mph.

The concrete antenna bases had to

be built to prevent any settling which could cause antenna misalignment. When concrete hardened (settled), it gives off heat which could melt the frozen ground and allow the concrete to settle or shift position. To prevent this from happening, copper tubing was placed in the wet concrete and refrigerated water was pumped through the tubing to carry off the excess heat and prevent the frozen ground from melting. The tubing remains in the hardened concrete.

To prevent settling of the concrete bases in warmer buildings, which would deform the antennas, slabs were laid under the floor and cold air is continually circulated to prevent building heat from melting the ground underneath.

Handling the difficult Arctic construction problems of the site was the responsibility of the Army Corps of Engineers, under the management eye of the Air Materiel Command.

As Force spokesman put before to the satisfaction of the Danish government is the BMEWS program. The island of Greenland is a constitutional part of the country of Denmark. A number of Danish citizens are employed in the site construction and wherever possible will be employed for the operating and maintenance staff at the site.

## Haloid Xerox Makes RC Circuit Modules

Rochester, N. Y.—Technique of making micro-miniature RC circuits by chemical etching of multilayered, pre-coated ceramic wafers and micro-miniature circuit modules has been developed here by Haloid Xerox, Inc.

Resistor-capacitor circuits are formed by successive deposition of resistive, conductive, dielectric and dielectric conductive films without regard to geometry by vacuum evaporation on ceramic substrate. All layers except the dielectric film completely cover the substrate. Specific circuits are then formed by selective ultrasonic etching and etching.

Resistor values from a few ohms to a megohm and capacitance from a few picofarads to over 100 microfarads have been achieved. Matched thin-film RC circuit plates can be stacked by inserting into drilled and etched holes in the end wafer etched conventional active components to be connected in end surface terminals and parallel to RC circuit plates. Printed conductive material on end plates is etched to form conducting paths and tube protruding from end plates are soldered for interconnection. Project is sponsored by Air Force Cambridge Research Center.

## Flight Patterns Displayed in 3-D

Detroit, Mich.—Chrysler Corp. has developed a new plotter that will make three-dimensional graphs of aircraft and missile flight patterns.

Compled to radar and on analog computers, the 3-D plotter can record and present an almost instant picture of a vehicle's flight path. At the present time, there is a great deal of three-dimensional data—like example, from a missile flight test—but, by necessity is being presented in two-dimensional form. As a result, Chrysler's Robert Felds points out, it is difficult to get an image of what is really happening.

One new 3-D plotter is scheduled to be installed at a test annexed an terminal for evaluation as approach and while other early production models are reported to undergo tests at White Sands Missile Test Range. Among other possible applications for the plotter, some of which are now under study by Chrysler, are weather plotting, satellite tracking, anti-aircraft fire control, sub-audible surface, and

wind tunnel data display. The company itself is interested in using the plotter for prepared machine tool control.

Then as how the device works. A vehicle, down to three axes by three potentiometer arms kept in suspension in a tank of transparent gel. Signals from an analog computer to the servomotors move the vehicle inside the gel as three sets of channels for multi-color tracings. Normally, the gel will be fluorescent for greater visibility under ultraviolet lighting.

As the vehicle moves through the gel, the ink, in pressure-fed out of the vehicle into the gel. The gel flows behind the vehicle, like quagmire, trapping the tracings. The ink traces can be kept permanently suspended in the gel as long as desired and then moved with a touch tube, or disappearing ink can be used.

For the future, Chrysler engineers are working on an electronic version of the plotter in which a three-dimensional recording scope will replace the gel, pen and ink.



NEW PLOTTER makes and leaves three-dimensional ink tracings in transparent gel.



## 880's START COMMERCIAL SERVICE

### CJ-805's Power Delta Jetliners

Atlanta, Ga.—General Electric engines entered commercial service for the first time on May 18 when Delta Air Lines' Conquest 880 Flight #873 left New York's Idlewild Airport bound for New Orleans' Morristown International Airport.

Flight #873 was the world's first 880 passenger service. It inaugurated Delta jet service to New Orleans. The second 880 flight left the ground while the first was still in the air, and Delta 880 service was fully underway. A jet-service Delta flight demonstrated the capabilities of the latest and the newest of the jets.

Delta's first 880 established a new coast-to-coast speed record on its recent total non-stop passenger flight. The 480 "Delta Queen" flew the 2389 miles from San Diego to Miami in 3 hours, 31 minutes, and 54 seconds.

Average ground speed for the record-breaking flight was 668 miles per hour. Delta President C. E. Wesloman, aboard for the flight, said, "This new



southern transcontinental speed record directly establishes the General Electric-powered Conquest 880 as the queen of the skies. The superb performance significantly and fully measured up to my expectations for both plane and engine."

More information on Conquest 880s powered by General Electric jet engines is found in GED-4575. See engine.

ITS A SWIFT AIRPLANE—C. E. Wesloman (left), Delta Air Lines President, discusses coast-to-coast record-breaking flight with T. F. Bell, Delta's chief pilot.



## General Electric's T58 Turboshaft Engine Completes 2000-Hour Endurance Run

Lynn, Mass.—General Electric's 1050-shp T58 turboshaft engine recently completed 2000 hours of endurance testing. The grueling test, designed to duplicate T58 parts life expectancy, simulated the demands which the engine would face during 4000 typical 30-second helicopter maneuvers. In all, 4000 starts and 11,000 hour equivalent tests were made. Conditions of parts

were excellent.

Developed for the U.S. Navy, the T58 is now in production and has accumulated more than 30,000 hours of total running time. Military applications include the Navy's HH-3 and HUSK helicopters, the Army YHC-1A, and two experimental vertical take-off and landing (VTOL) aircraft, the Kaman K-26 and Fairchild M26J.

The engine's commercial counterpart, the GT58, has been selected to power Sikorsky S-61s, ordered by Los Angeles Airways and Chicago Helicopter Airways and Vertol 97s, which New York Airways plans to use. The GT58 also powers Sikorsky's S-62 amphibious amphibious helicopter being offered to corporate charter and airline users.

More detailed information on the T58 program is found in GED-1985. See engine.

## J85-7 Powers GAM-72 To New Altitude

Holmden Air Force Base, N. M.—McDonnell Douglas GAM-72 decay altitude successfully completed its first test flight recently with General Electric's J85-7 production turbojet. The engine allowed to power the "Green Quest" when it enters service with the Strategic Air Command. Air launched or operational altitude from a 30-50 bomber, the missile completed its automatically-programmed flight without incident, reaching the highest altitude of 115,000 feet to date.

Although the GAM-72 has been flown with a development J85 engine, this was the first in a series of mission simulation flights aimed at proving the way for release of the production missile system to operational SAC squadrons.

J85 engines have now completed more than 15,000 test hour tests.

More information on G.E.'s J85 production turbojet, the "Green Quest" and other applications, is available in GED-4054. See engine.



CJ-805-23 INDEPENDENT POWER PLANT—General Electric's all fan engine power the B-55.



B-55 POWERED BY APF FAN ENGINES—G-E based aircraft in flight, fitted with Conquest 800 engines.

## CJ-805-23 Highly Successful: 1st U.S. All-Turbofan-Powered Flight

Edwards AFB, Calif.—For the first time an engine manufacturer flew turboshaft engines as primary powerplants when General Electric successfully flight-tested two CJ-805-23 engines recently. A G-E based Air Force B-55 flew for one hour and 43 minutes at altitudes up to 35,000 feet, and speeds up to Mach .85.

Flight tests are continuing with outstanding success. Both engines are mounted in Conquest 800 production nacelles. Through these tests, General Electric will supply specific data on the pods, how the 660 lbs for the first time.

The all fan CJ-805-23s underwent extensive ground tests in Conquest nacelles before the latest flight.

Conquest 800s, built with the CJ-805-13s, have been ordered by American Airlines, Scandinavian Airlines System, Bureau of WEAL, (Bureau).

As part of its continuing all fan flight test program, General Electric recently purchased a Conquest VII from Bell Aviation. West Coast tests of the Conquest VII fan nacelles have already begun. Flight tests will begin in early July, leading to early certification of the all fan-powered jet.

It would like additional information about any of G.E.'s all fan engines, send the coupon below. For CJ-805-23 information, GED-4192. For Conquest 800, GED-3184. For GED-4082.



4000-LB THRUST APF FAN IS UNMATCHED—This is the first all-fan nacelle of General Electric's new GT58 turboshaft engine, recently announced as the first small all fan engine specifically designed for light- and medium-weight aircraft being offered to corporate, military and airline users. Being developed under G-E sponsorship, the GT58 combines the J85 gas generator and a variable-stroke version of the CJ-805-23 all fan to produce 4000 lbs thrust with a 0.65 SFC. Rightweight engine will be available in April, 1967. FAA-certified engine in February, 1967. More GT58 information is contained in GED-3956.

## B-58 TIME RECORD SET

Fort Worth, Tex.—The Air Force's B-58 "Mighty Waco" powered by General Electric's T58 turboshafts, made a vertical flight of 18 hours and 39 sec, was recently to set a new "Hardie" endurance record.

"Mighty Waco" was refueled twice during the flight. Flown by Lt. Col. Leonard A. Legg, the B-58 took off from Carswell AFB at 8:45 p.m. March 23 and landed on the same strip at 12:19 p.m. the following day. The flight covered approximately 15,000 statute miles.

## FAA Awards C58 Production Certificate

Lynn, Mass.—General Electric's Bell Aircraft Engine Department has been awarded the first original helicopter gas turbine production certificate to be granted by the Federal Aviation Agency. The certificate authorizes quantity production of G-E's C58-122 commercial helicopter engine without FAA inspection of each individual powerplant.

The engine itself was certified by the FAA for commercial helicopter service on July 1, 1965.



PRODUCTION CERTIFICATE AWARDED—G-E Small Aircraft Engine Department General Manager Gerald Mowman (left) accepts production certificate number 102 from Walter H. Ross of FAA.

The advantages of C58-122's advanced nacelle design are described in detail in G.E.'s illustrated brochure, GED 3547. See coupon below.

FOR MORE DETAILED INFORMATION on these and other developments in General Electric aircraft powerplants, contact your nearest G.E. Flight Propulsion Division representative or indicate below the brochures you would like to receive.

General Electric Company  
Section 4204-15  
Schuylkill, Pa. 19380

☐ GED-474, "C58-122 Program Report"

☐ GED-3956, "GT58-15 Turbojet"

☐ GED-4054, "All Fan Turbine Report"

☐ GED-3956, "T58 Program Report"

☐ GED-3957, "C58 for Commercial Helicopters"

☐ GED-4054, "T58 Program Report"

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## 9999 FILTER CENTER 00000

► **Very High Power Transistors**—New family of high frequency silicon transistors, which have maximum collector currents as high as 100 amp, giving them a power rating of up to 1,500 watts, has been developed by Pacific Semiconductor Inc. under Wright Air Development Division sponsorship. Experimental samples of a 10 amp, rated at 350 watts, are now available. PSE's Frank J. Strimbury told the latest Naccon in Dayton. One such unit has been operated at 16 sec. with an output of 150 watts and a collector efficiency better than 30%. Therefore reported. Transistors will be available in two packages: one for air cooling, the other for water cooling.

► **Low Antennas For Space GSR**—Ground support equipment (GSE) required for space probes is less restricted, less complex, less costly than that needed for weapon systems. Milton C. Peterson of Space Technology Laboratories told the Dayton Naccon. "For non-offensive space probes, it is more expedient and reliable, and also more economical to use lighter limited personnel than to spend time and money for the design of sophisticated equipment," Peterson said. He also pointed out that severe weight restrictions in space periods eliminates the use of aerial reconnoiterers such as hot blips, mechanical recon probes and lifting points. C. T. Ransom of Lockheed's Missile and Space Division pointed out another important difference between space vehicles and weapon systems: the latter need to be kept on continuous alert, ready for launching on a few minutes notice, which requires continuous monitoring, while space vehicles do not.

► **Reflections on Reliability**—Donald E. Noble, executive vice president of Rembrandt, told Naccon that "When I attended an air meeting on reliability, I found an atmosphere not unlike that which would exist in a group of hospital patients all waiting for someone who had gotten together to exchange blood transfusions."

► **FM/AM Telemetry Proposed**—Radio communication that prevent FM/AM frequency division telemetry systems, which has been the standard for 15 years, be changed to FM/AM, was made at Naccon by Paul Lacombe, L. Rausch of the University of Michigan. The change, Rausch said, would reduce amount of radio spectrum and would permit use of both demodulation and data reduction methods. He concluded that there would be a slight

loss in signal-to-noise ratio by changing to amplitude modulation, but added that this would be more than compensated for by the improved data processing which FM/AM apparently enables possible.

► **Scatter Detection of Space Objects**—Adaptation of forward scatter cross modulation techniques might prove reliable for detecting satellites, Capt. Peter Toland, Jr., Wright Air Development Division, suggested in a report to Naccon. Proposed technique would spot satellites by detecting ground transmitted energy which bounces off and is received at another station. Optimum frequency would be about 30 mc, Toland estimates.

## NEW AVIONIC PRODUCTS

► **Klystron amplifier tube, K-1270**, is capable of producing peak 300 watt with 100 mc bandwidth centered at 1.5 mc in



1. band. Amplifier has maximum gain of 30 db, flat bandwidth and linear phase shift characteristics over specified bandwidth.

Lexon Industries, 960 Industrial Rd., San Carlos, Calif.

► **Klystron tube models, DB-111**, are designed to provide coupling between output of small reflex klystrons and standard size waveguide. Units are insensitive to input 1,000 v peak and are available in five sizes to handle tubes



in 2.6 to 9.6 mc frequency range. Prices are \$277 to \$315, depending on size and configuration, and 30 db delivery is offered. Bethlehem Records, 780 Arroyo Place, Pasadena, Calif.



► **Searcher servo amplifier**, which includes gear train, motor mechanism, control transformer, transformer amplifier and power supply, has zero backlash between the servo control transformer and output shaft. The 26-v. amplifier has rated static accuracy of 0.25 deg. maximum at a 7 mm reference input, velocity constant of 100 deg./sec./deg. and a rise velocity of 30 rpm. Input requirements are 115 v, 60 cps at 5 v. Dimensions are 2.6 in. diameter by 4.2 in. long. Orbit Instrument Corp., 131 Edison Way, Syosset, N. Y.

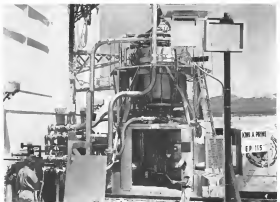
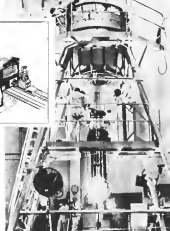


► **Klystron power amplifier, Model 210 A**, supplies 2 kilowatts and operates over 7,125 kmc. to 6.5 kmc. range with a gain of better than 46 db, when operated as broadband amplifier. Minimum bandwidth at 1 power points are 15 mc staggered tuned, and 10 mc synchronous, broad. Seena Electronic Corp., 2885 Buchanan Dr., Menlo Park, Calif.



## Second Project Rover Reactor Prepared for AEC Power Runs

Second reactor in the Project Rover nuclear rocket power program, Kirt A. Power (above right) is scheduled to begin power runs in July at Atomic Energy Commission test site in Idaho Falls, Nev. Test Cell C (above) has a more advanced reactor that will use liquid hydrogen as a cooling fluid. It is expected to be ready for use next year. Kirt A. Power, who is president of Kirt A. Power, will not operate hydrogen (APR May 23, p. 57). Mock-up of Kirt A. Power (below) will be used to check instrumentation for actual reactor. Power program is a joint project of AEC and National Aeronautics and Space Administration.



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## BUSINESS FLYING



ARTIST'S conception shows close-up of SIAT 222 shows excellent cockpit visibility.

## Four-Seat SIAT 222 Prototype Nears Completion in Germany

Hannover, Germany—First prototype SIAT 222 is now nearing completion at Dornierwerke, Germany, and is expected to make its first flight early this fall.

Siebelwerke ATG, GmbH of Dornierwerke, a member of the Boeing Group, announced the new low-wing, four-seat plane at the air show here.

The aircraft at the end stop in Siebelwerke's previous SIAT 202. It has two-seat version, which still holds two world records for high altitude flight.

Designed primarily for sport and business flying, the SIAT 222 is also suitable as a trainer and for glider towing purposes. In addition, as a single unit, it is fully aerobically.

Powerplant is a single four-cylinder, six-cylinder Lycoming engine rated at 150 hp, driving an electrically controlled variable-pitch Hartzell propeller. Maximum speed is 199 mph.

Wing tips are detachable and, in use, enable the plane to start or land on very small airfields, the outer wing sections are fitted with flaps, the outer sections with retractable light flaps.

Fuselage is an all-metal, semi-monocoque structure. Cockpit, fitted with dual control seats, allows all-round visibility. The cabin has opening-closing doors, one on either side which provide can entrance or exit. A pressure hand-operated lever is provided to detach the door in an emergency.

Baggage space, accessible from outside, is provided both in front of the cabin and in the rear of the back bench. Both overhead and landing gear of the aircraft are mechanically actuated and also-power-assisted shock absorbers combine both starting and landing operations considerably.

Normal standard instrumentation is provided and full blind flying equipment is available as an optional extra. A definite price for the SIAT 222 has not yet been fixed, but Siebelwerke expects to market the standard model for about \$15,500 (DM 62,000) and a more refined version for approximately \$17,500 (DM 70,000) including blind flying instruments.

### SIAT 222 Specifications

Dimensions	
Span	36.50 ft.
Length	25.22 ft.
Height	8.97 ft.
Wing area	171 sq. ft.
Aspect ratio	8.65
Weights	
Empty weight	1,165 lb.
Useful load	1,020 lb.
Gross weight with two passengers	2,185 lb.
Gross weight with two passengers	2,185 lb.
Gross weight with two passengers	2,185 lb.
Performance	
Maximum speed	199 mph
Cruising speed	160 mph
Landing speed	65 mph
Rate of climb	21 ft./sec.
Service ceiling	22,900 ft.
Range	745 mi.
Takeoff distance (90 ft.)	805 ft.
Landing distance (90 ft.)	460 ft.
Fuel	
Contents of wing tip tanks	23 gal.
Contents of auxiliary wing tanks	7.7 gal.



### Fairchild F-27, Convair 240 Executive Interiors

Interior of an F27 Fairchild Convair executive transport demonstrated, owned by Fairchild Engine & Airplane Corp., was designed for low density seating by Hutton & Hutton Contract Works, Inc., Ft. Worth, Tex. Below is interior of Fairchild F-27 and Convair 240 demonstrated in 17 passenger configuration (AVR 4-4, p. 119), which was modified by AirResearch Aviation Service Co., gross weight is 42,500 lb.



Small part, large part, structural in bonding —see the standard unbonded flange (17-45) "Teflon" from R/M as the piece to get it.

## For component miniaturization, THINK "TEFLON" from R/M

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## Bulova ICBM Igniter Has Safety Feature

Woodcliff, N. Y.—Bulova Research and Development Laboratories has developed a novel igniter safety mechanism for the first stage Minuteman intercontinental ballistic missile rocket engine. Several units have been delivered to Lockheed and are now undergoing preproduction qualification testing. One purpose of this new mechanism is to prevent accidental first stage ignition and, at the same time, to ensure that the engine will fire when it is supposed to. To achieve these three contradictory goals of adequate safety and reliable operation, the Bulova unit employs a unique procedure: first with one new moving part.

An early approach to the problem suggested the commonly used method of interposing a metal barrier between the electrical igniter and igniter pellets (both contained in the igniter box at the base of the first stage engine). Prior to ignition, the barrier would be actuated out of the way. But its subsequent removal also had the disadvantage of an accidental firing of the igniter, engineers found, the barrier had to be so large that it lowered the reliability of propulsion—that is, when the barrier was actuated out of the way for a planned firing, the resultant gap was so wide that the ignition force from the



**Martin Bullpup Trainer Missile Fired in Tests**

Martin T4GMB4 trainer version of the Martin Bullpup as test vehicle in tests from a wingless booster affixed to a ground test stand at Naval Air Test Center, Patuxent River, Md. Martin is producing the trainer version for Air Force pilot training in North American F-106 jet fighters.

igniter would not shrapnel upon it with sufficient energy to set off the igniter pellets and initiate burning in the first stage engine.

Brought into the program with a substantial first thought, Bulova found that there was no way in the conventional intercontinental ballistic missile scheme to separate the safety problem from the proper grain problem. Bulova scientists took a different approach—one in which the two problems could be separated—and developed a device in which the igniter can be brought close to the igniter pellets in necessary to ensure propagation and ignition without affecting safety in any way.

To achieve this separation of safety and ignition, they mounted two igniter and electrical switches on a motor shaft assembly which rotates under a stationary housing that holds the igniter pellets. In the idle position, the igniter pellet is at an extra thick section of the stationary igniter pellet housing that would block flame and heat from an accidental firing of the igniter. Also, in this position, electrical contacts to the igniter pellets are open and each igniter is shorted through itself to prevent premature activation of the igniter by electrical noise or the like.

To arm the unit, an electrical signal is sent to the motor and the shaft assembly begins the spins and the electrical contacts to the igniter pellets are closed to initiate approximately 120 deg to the arm position. In this

position, the flameproof pellet is closed and the igniter pellet is a section of the igniter housing that is only 0.001-in. thick. When the firing signal is given the igniter pellet through the thin wall and detonate full grains of igniter pellets contained in a number of cells of this surrounding structure housing.

The enclosed igniter pellets burn rapidly, igniting flame and hot gases through a perforated plate in the base of the igniter housing into the engine where, this, initiate burning in the solid propellant grain. Once the start is armed and before the firing signal is given the device can be returned to a safe position either electrically or mechanically. (An operational requirement specifies that the device is to be armed only electrically.) An added safety feature of the mechanism is the visual indication of the status given either by the letter S or A which appears in a small window in the device. The hermetically sealed unit also has an electrical position indicator as well as a mechanical steel roller locking device.

The igniter release mechanism weighs 4.5 lb.

It is 3.4 in. high by 4.75 in. in diameter and including its projecting wiring and connectors.

Bulova is also doing research and development on a detent mechanism for the Minuteman first stage that for standardization purposes makes use of the same basic components used in the

### Solid-Propellant Bids

Washington—Competition held by Wright Air Development Division for a new midrange ground-based solid propellant rocket, in which Aerojet-General Corp. was selected the winner (ENR Feb. 22, p. 35), has been revised and expanded again for new bids. Those not expected to be submitted in some future by Aerojet, North American Aviation's Rocketdyne Division, United Technologies Corp., Thiokol, Alloué, Ballistic Laboratories and General Electric Rocket Co., which saw the latter bid lose and possibly other companies.

Initial contract is expected to be for one vehicle and test of a model only, within the length of an operational version, with a loading of about 35 million. Follow-on ballistic development contract may call for rocket delivery within 30 months.

Igniter subunits were at a spacecraft mounting setup in the detent device, which is set off to the side of the centrally located igniter base on the base end of the first stage engine, explosive detonators are and in place of conventional longer tubes, flameproofing igniter. The shock from the detonator sets off a high explosive charge which shatters the motor casing in a controlled pattern.

### Polaris Sub Simulator Designed for Navy

Mississippi—New submarine marine simulator, for training crews of Polaris fleet ballistic missile and other nuclear submarines and for use in sea games, will be developed by Mississippi-Hanover's Guidance Division under a \$16 million contract awarded by the Naval Training Device Center.

The device, which will occupy a 10-ft long of a three-story building at Navy's submarine school at New London, Conn., will provide complete simulation of three different submarine fleet trainers, with realistic water and water waves at its command, providing the maneuvering of the sea level stage.

The new nuclear submarine simulator will be used for various types of operations, for training command and staff officers and for developing tactics, as well as for training simulators of submarine crews in use of their weapons for attack and defense.

Crews will be monitored from a master submarine's console and the overall battle situation will be displayed on a large screen in a war games room. Heart of the system will be a Honeywell 800 digital data processing system.

## THERE IS NO CEILING ON IDEAS



Advanced hydrogen systems being developed by The Garrett Corporation solve the problem of keeping main drive and space engine operating for long periods of time in future satellites and space capsules.

Engineers at The Garrett Corporation's Allentown Manufacturing Division are dealing with challenging problems in fast-moving fields.

Diversification of effort and vigorous leadership have made Garrett the world's largest manufacturer of aircraft components and systems and a leader in special test facilities and operational systems.

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- Aircraft Flight and Electronic Systems—Largest supplier of airborne environmental flight data systems, also working with other electronic test and measurement including missile and submarine applications.
- Missile Systems—Largest supplier of auxiliary power units, Allentown is also working with hydrazine, hot gas and hydrogen systems for missiles, liquid and gas propellant rockets and controls for ground support.
- Gas Turbine Engines—World's largest producer of small gas turbine engines, with more than 9000 delivered in the 30-600 hp class. Subdivisions include industrial and nuclear applications.

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MINUTEMAN first stage igniter unit arm mechanism can be mechanically held in "off" position by pushing spring-loaded shrapnel into spring-loaded valve. Tool is also used to remove expanding steel roller in the mechanism that serves as a safety lock during shipment and storage.



## External Changes Noted In Soviet Missile Show

Maneuvers shown during the recent May Day parade in Moscow's Red Square were almost identical to those paraded here in the fall of 1957 when the Soviets provided the first public look at their newly tested during the fifth anniversary of the Communist revolution. External changes on the missiles are minor. Streamlined Soviet jets resemble missiles (above and right) apparently had eight new flash antenna locations near its nose. These missiles were followed by Shostakovich type rockets (below), liquid and solid fuel boosters (missiles) (group up to 200 m/s) and T-2 type IIRBs.



New method shape was only significant change visible on tactical missiles (below) and their sophisticated carriers during May Day parade.



## EQUIPMENT



**PRECISION** altimeter shows corrected altitude from data computer or a radio altimeter without dependence on electrical power.

## USAF, Navy Evaluate Precision Altimeter

By Barry Toffy

New York-New precision altimeters will display corrected altitude transmitted by systems from a remote source with a fuselage pressure mechanism to serve in the event of electrical malfunction. The altimeter, developed by the Koffman Instrument Corp., has been ordered in evaluation quantities by the Air Force and the Navy.

The Koffman compensated altimeter provides a counter-pressure altitude display reading from —1,000 to 100,000 ft. The advantages of the instrument set that it will display corrected altitude from an air data computer in a radio altimeter without dependence on continuous electrical power. In the event of electrical malfunction, the altimeter will revert to static pressure operation, indicate to the pilot that it is in the standby (low pressure) mode and protect with the precision of a standard military MC-1 altimeter. The pilot may select the standby mode at his option or attempt to react normal operation of the altimeter in the case of momentary power interruption.

### Altimeter Reliability

The compensated altimeter is an attempt to combine the reliability of the mechanical static pressure altimeter with the precision of the electric altimeter. The dependency of the all electric altimeter upon continuous electrical power has posed a serious blow to its acceptance, despite many design advantages. All proposals for electric altimeters call for the use of a standby mechanical instrument serving as the

outlook of a standby computer. The military services, however, the interpretation of the standby computer notwithstanding—have been reluctant to accept an altimeter which requires a backup instrument on already cluttered panels.

The advantages of the electric altimeter include response to acoustic signals, the inherent precision of the non-ballooning circuits and sufficient power to drive the more sophisticated (for design) altimeter display. The Koffman compensated altimeter reportedly satisfies the usage and precision requirements with reliability. However, its display is limited to one that can be powered by barometric pressure. If the altimeter is to obtain direct static altitude display which cannot be powered by barometric mechanism, it must otherwise resort to backup altimeters.

The mechanism of the compensated altimeter is essentially the standard precision MC-1 unit with addition of a hybridized rotor and a drag cup sensor prior to the geared shafts, so the MC-1 altimeter mechanism. The hybridized, a computer development is used to is traction altitude variation due to bond sources and in the Koffman integrated flight instrument system on jet transports. The wipers, containing neither bearings nor brushes, transmit the electrical functioning of altitude data with undisturbed accuracy without the use of a servo in the transmitter.

The altimeter rotor of a drag cup servo motor, weighing 67 grams, is mounted directly on the power shaft. On an auxiliary shaft, which meshes

with the pointer shaft piston, it mounted the rotor of the hybridized (1075 gram). The Synchrostat transmits for every 10,000 ft. of altitude. The static housing of the Synchrostat is rotated by the barometric spring error to drive. Limiting the rotation to 120 deg. obviates the necessity of using slip rings on station leads. A translator servo amplifier with a multibeam detection position is incorporated in the radio range unit. The display is a standard counter pressure presentation with a warning flag to signify standby mode of operation.

### Servo Motor

Standard rotation of one turn for 10,000 ft. on the indicator was chosen to provide the widest range of correction consistent with maintaining synchro-rotor contact. The radio altimeter's constant mechanical connection to the dragcup mechanism creates the pointer to be approximately to correct position (within ±1,000 ft.) of all error. Thus, no coarse (slow) speaker input is required to avoid any lagging.

The Synchrostat states, in several operations, is recognized by the line structure transmitter in the external computer or other source of altitude signal. The error signal is amplified to drive the control shaft of the drag cup servo motor. This motor, by directly driving the pointer shaft, positions the pointer, thereby and the Synchrostat rotor to establish servo null. In establishing servo null, the rotor overrides the altimeter mechanism to the transmitted value of altitude. The servo provides



JUNE 20, 1960 Aviation Week



# SAC IN TRANSITION

The changing role of the Strategic Air Command in the national defense picture will be featured on June 20th in a special 36-page report prepared by AVIATION WEEK editors with on-the-spot coverage of the SAC Command—The nation's shield against aggression.

This exclusive report will be published in answer to the growing requirement for an improved national understanding of SAC's changing role as the primary deterrent force guaranteeing national security. The annual S&D issue will be devoted to this message which is today's most challenging subject.

The Strategic Air Command's deterrent position has undergone complex and fundamental changes in its transition to a Strategic Aero-Space Command—with its formidable bomber fleet now to be reinforced by intercontinental ballistic missiles operantly deployed to instantly counter any aggressive action.

The transition of SAC is one of the most rapid and exciting events in the history of our nation and its defense. What SAC needs, what lies ahead and the weapon systems to be employed in the immediate future will be key subjects included in this first-time technical evaluation. The impact of new technologies and weapon systems has changed the entire defense concept and the response of SAC to these new requirements has been effective and positive.

AVIATION WEEK editorial teams are now engaged in the compilation of the new SAC story—one that will generate world-wide readership. This issue, "SAC In Transition," offers manufacturers and suppliers of the aerospace industry an unusual opportunity to advertise and identify their role in the national defense effort.

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... Space Technology

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ARTIST'S CONCEPTION  
OF A MINUTEMAN ICBM  
AIR LAUNCHED BALLISTIC MISSILE





relation. Each sentence has a unique  
its results on the lower bound in the

Never have I heard such a sad story. As an aircraft commander in SAC just finishing a frequent week-day short tour, I am Power Winner "7304 Fastlane" letter to you May 9 was needed my heart. When my telephone rings, I can't give the back to Mr. Power Winner does When SAC calls, there's a time called DUTY to be attended to and one comes a meaning.

### Dusty Strategy

The next observation is an illustration of the United States concept of "massive retaliation" to me. I see it. The phrase calls to mind a creature of one leg, thus, there is only one leg. One leg? (Borah: "There is nothing a gun (nuk) can do to me.") I am adding you (the other [the United States], the United States is me). "Is my pocket? I have a stick of dynamite all ready to go. You don't see that do you because I have such sense. I suppose in my pocket there you have as your gun. Besides, if you happen to take it out, I would see it right away. I can stick out of my pocket and I can see and shoot it if you take it out. You don't see that too fast or too fast, you too will be destroyed." The probability that any of these conditions would obtain is almost

DAVID A. STRICKLAND  
Minneapolis, Minn

In the article "Fight Nukes in Air Alert Controversy" (SW May 2, p. 1) Dan Power is quoted as saying, "You have lived there (Soviet consider) in other cities in the U.S." The comment was made regarding the Navy's Polaris program. It would, indeed, be imprudent to continue on a track which would make domestic areas more vulnerable and more easily accessible.

a "hot" story. The implications are clear, but the basis for such a conclusion is somewhat less than crystal. It would appear that some alibi might be left standing in order to give the remark an air of legitimacy, to remove the stain of "hot grapes" which seems to crop through. Can this have the SAC's attitude toward Palomo made worse by some other than SAC at the instigation of the program, "shaded, unshaded, never used"—as it progressed, interesting, surprising, tremendous, must be incorporated in our annual—since when it was clear that the Navy would not readily turn over Palomo to SAC?

*Attention: We welcome the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Attention: Book, 230 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a complete identification. We will not print anonymous letters, but names of writers will be withheld on request.*

Deployment and employment, "too expensive, you have died than to attack others in the U.S." The one consistency easily seen in this attitude is anti-Americanism.

Although it could go without saying, the authors of the Manifesto, with which Polansky would be replaced, in such that it meant even if less well said, comprise what the great advantage of a Polansky or Polansky-type system. One might be tempted to say that the only common ground of Polansky and Manifesto is that they are mutually. Quite obviously Manifesto, despised or not, holds two essential requirements of an ideal: within launching and maintenance and a high degree of mobility. These two dear old features are readily visible in Polansky, also, a subconic launching platform has the solid quality of obliquity.

Severely put out of the earth's surface offers a mechanism through which such a vessel might pass with a low probability of detection. Such a vehicle could launch its weapons, withdraw, and launch another weapon from miles away while a few hours each activity would produce one or extended period of time until the desired result was achieved.

Forming with the above controversy, I should like to get to the fundamental question: is the world's weather; above is such stark that its military expenditures need seek to progress at the expense of the other services which are, by and large, trying to do their job as effectively as possible? Has it been called to the attention of all service personnel that all ser-

the more fundamental goal, and that as hard as it might be to accept we are on the same side? What about the public, who have not yet faced these challenges? What prior failures, if it has occurred?

Please make it known that my comments in no way reflect the Department of the Navy's stand or opinion, but that they reflect only a brought-on crisis's despair.

WARREN W. SCHILLGARD  
Ensign, USNR  
Washington, D.C.

In reply to Mr. J. L. De Celles' "Accident Cases" letter (AW Apr. 21, p. 190) I not only validly disagree with his theories but lack Mr. Quisenberry the bar in that newspaper pseudonyms were used by the Albany post in the Williamsport Pa. case.

My main point of argument is that at no time did Mr. De Colles mention maximum altitudes. Granted, the pilot completed a normal landing approach with all instruments functioning, seemed fixated over the field on the first try, but violated the cardinal rule of not reaching the surface.

and mixed approach after long sight at the article

It states on the Andrew's plate that the largest maximum altitude does not proceed otherwise nor the ridge approximately 1.7 km south of the airport. The wreckage is located about 500 m below the ridge line. It is "quite possible" that the pilot was attempting to reestablish his position not based on the real course of the LF range using the ADF, as well to find the "lost field," which is an aerobically generated field. Had the pilot been monitoring the actual range speech he would not have passed south of the ridge top. The fact that he was not seen before authorized maximums is what put him in trouble, hence the magnitude

Believing in the theory that the capital suffered a heavy attack immediately prior to the crash, I feel sure that my normal "good conditions" would suffer an attack while riding through the particular approach.

Victor Gomer, Capt., USAF  
Commander, Helicopter Unit  
Glasgow AFB, Pa.

Know how much it would cost to wipe out the month gap? Only five cents a day! Don't believe it? Check these figures: The assumption is made that the 1981 month gap can be wiped out by a major effort providing 200 Alfa machines and above percent planned production during the next 24 months. It is assumed that 14 months will be required for preparation, and that the monies will be produced in 10 months at a rate of 20 per month.

Obviously, this would require a large increase in production facilities. Canadian brewers should be made for accident-free roads. The cost of \$1 billion is included for that purpose. Each vehicle is assumed to cost \$20 million additional road to fix, at a finished rate of less than 10%.

*(The above are estimates.)*

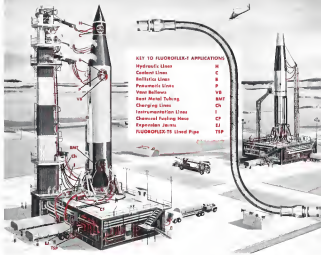
The total cost of the two year program is then \$1 billion dollars. Is this a lot of money for a rich country of 179 million people? It is not!

If 179 million people should each sit inside their train a day, for just two years, they would provide a sum equal to \$5,215, 180,000.

Contrary to the gloomy prophecies of fiscal responsibility, there is no inflation, no debt, no federal deficit in this simple proposal. Just a modest increase in taxes. Consider how little we would have to pay:

As for the way of expertise, whisky, melted milkshakes, cream soups, chocolate puddings and the like to provide that four-course a day. Are not the real values of the Amers can way of life worth this small sacrifice?

James McNamee  
Barnes, Pa.



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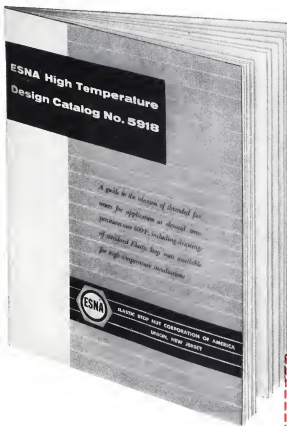
James O'Brien is a frequent speaker.

\*Führer ist ein Anführer (nicht nur), sondern ein Führer.  
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